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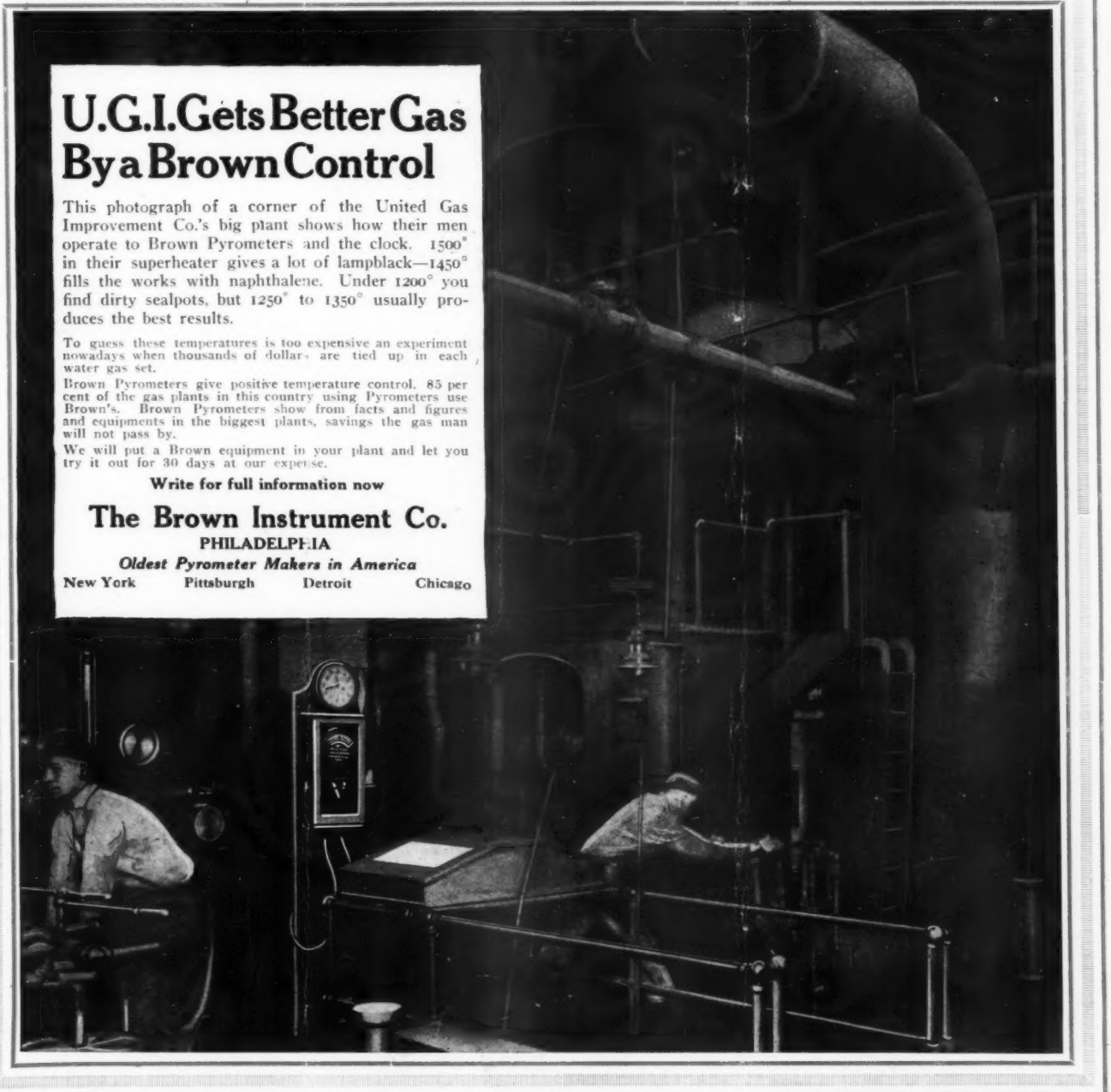

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INDEX TO CONTENTS, PAGE 452 ADVERTISERS' INDEX, PAGE 20

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AMERICAN
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Generator the Heart of the Water Gas Set and Nearly All Trouble, Directly or Indirectly, Emanates in Fuel Bed

Rules for Practical Economy in Water Gas Manufacture—Possible Savings in Fuel and Oil Used—Importance of Daily Records for Future Use

By C. H. HODGES

The writer has prepared this paper with the aim always in mind to treat the subject in the most elementary and, at the same time, most practical way; the idea being to give as much information as possible in such form as can be readily assimilated by anyone familiar with water gas operation. He has simply endeavored to collect, systematize and present as simply as possible the knowledge he has acquired as to methodically analyzing, checking and eliminating the numerous factors which tend to lower manufacturing efficiency, merely giving what he believes is true from his own experience, and realizing that others may have entirely different ideas on the subject. He hopes this paper may be of some help when looking for manufacturing troubles; especially with beginners, enabling them to acquire in a short time what may otherwise take many years to learn by experience. For usually it is the discovery of that simple cause which has for a time produced low efficiency which may be the means of attaining high efficiency.

It is most important in water gas manufacture to keep daily records of all operating conditions so that they can be conveniently used for reference. By this is meant, not only the results such as oil and fuel per 1,000 cu. ft. per square foot of grate surface per hour, tar per M., etc., but all the actual operating conditions under which these results were obtained; such as steam per M., steam per minute, blast pressures, length of blows, length of runs, portion of run up and down, CO_2, illuminants, kind of fuel, analysis of fuel, kind of oil and the distillation thereof, so that at any future date these same conditions can be compared or reproduced if desired.

Sensitive Balance By No Means Permanent

It is assumed that the reader is familiar with the general operations of a water gas set, and knows from experience its peculiarities and realizes that the sensitive balance of a set does not remain long before some cause (often beyond the control of the operator) upsets operating conditions. Like so many card houses, all conditions are upset, causing poor general results. Right here is where we use up most of our mental energy through worry, and this point of how "to get right" is the real object of this paper.

I have set forth a list of factors which have, from time to time, been found to cause poor fuel and oil results. First is given the list of possible fuel troubles in the order of their prevalence, then each item is taken up in detail.

The idea is to go from one item to the other to determine what may be the trouble. These causes are generally known, but their significance is not always appreciated. It is the application of a system that plays a very important part in this paper.

Causes of Poor Generator Fuel Results

(1) Too high or too low CO_2.
(2) Incorrect steam balance in set.
(3) Fires clean too soft or too hard.
(4) Dirty, wet or small fuel.
(5) High per cent of ash in fuel.
(6) Fire cleaning.
(7) Length of blow or run either too short or too long for kind of fuel used.
(8) Grate bar spacing too wide.
(9) Steam per M. too high or too low.
(10) Change in coal.
(11) Coal very fragile and cracks up.
(12) Sets coaled unevenly or not to proper level.
(13) Atmospheric changes, such as humidity and barometer.
(14) Careless operating of set.
(15) Too much blue gas wasted at stack.
(16) Leaky or dirty hot valves.
(17) Irregular coaling or cleaning.
(18) Sets not run on correct time.
(19) Steam gauges incorrect, or steam not measured accurately.
(20) Unnecessary delays when cleaning fires.
(21) Leaky steam valves.
(22) Changing over from coke to coal.
(23) Shutting down and starting up sets.
(24) Irregular changing over hot valves.
(25) Coal and coke not mixed properly.

(26) Coal irregular on day and night shift.
(27) Low oil per M.
(28) Wet steam.
(29) Inaccurate meter registration.
(30) Inaccurate scales or fuel inaccurately weighed.
(31) Clerical errors in office.
(32) Steam and blast pressure irregular at blower or at individual set.

(1) Too High or Too Low CO_2

When using anthracite coal with 20 to 30 in. blast pressure in the ash pan, the best fuel results are obtained when the CO_2 is between 3.2 and 2.8; when using gas house coke, between 3.2 and 4.2. If the CO_2 is higher than that just stated, then the total steam should be reduced; if lower, it should be increased.

(2) Incorrect Steam Balance in Set

The correct steam balance of a set is obtained when the amount of steam used in connection with air used gives the best results. As a general rule the total steam should be regulated according to the hardness of the fires, as will be taken up in our next item. There are some coals that require considerable more total steam than others, and this is found by experience only. Just a few pounds of steam per minute added or taken off a set will often lower the fuel 1 or 2 lb. per M., and at the same time increase the make without changing the fire conditions noticeably. At the same time, it may only change the CO_2, 0.2 or 0.3 of 1 per cent.

After a little experience and a few trials, the steam balance is usually found.

It is most important that the steam be measured accurately. If things are not improved, then go to the next cause.

(3) Fires Clean Too Soft or Too Hard

Note during the cleaning period the condition of the fires. If they are so soft that they fall down before the fire is properly cleaned, then the up steam must be decreased and the down steam increased, remembering always to keep the CO_2 within the limits given in item (1). If the fires clean so hard that the big clinkers are neither removed or broken up, then increase the up steam and decrease the down steam. It is a very common thing to observe very good fuel results for the first day or two as the fires are getting hard, but all the gain is lost by the drastic measures required to soften them up again. Hence, it is wise not to let the fires get ahead of you.

(4) Dirty, Wet or Small Fuel

Dirty, wet and small fuel cause more trouble than the average water gas operator realizes.

Dirty fuel, meaning fuel with very small pieces mixed in, throws an increased differential pressure in the fuel bed, reducing the amount of air which passes through, and, consequently, reducing the make and lowering all results. Any method of cleaning the fuel, if only forking by hand, will pay for itself many times over.

Wet fuel cannot always be avoided, and it not only lowers the fuel bed temperature but large quantities of fine fuel adhering to the large pieces are carried into the generator, hence dirty fuel.

Small fuel of uniform size, even though clean, will increase the fuel per M. from 1 to 2 lb., as is experienced when changing from broken coal to egg coal. The gas make is also reduced in about the same proportion.

(5) High Per Cent of Ash in Fuel

It is obvious that the higher per cent of ash in the fuel the less will be the per cent of carbon for gas making, other things being equal. The fusing temperature of the ash in generator fuel is a good guide to operation. The fusing test should be made on each sample of coal with its analysis. It is desirable to require a high fusing temperature ash coal when purchasing.

The temperature required for the decomposition of steam by carbon is between 1,800 and 2,600 deg. Fahr. Therefore, a fuel whose ash clinkers below 2,400 causes extra trouble from clinkers when cleaning fires.

(6) Fire Cleaning

This factor is a very important one, and no fire should be cleaned without one in authority, such as a foreman, being present; for there seems to be an instinctive tendency to shirk fire cleaning more than any other kind of work in a water gas plant. A healthy fire condition is always vital.

(7) Length of Blow or Run Either Too Short or Too Long for Kind of Fuel Used

It is very difficult to state any rule that will apply to all conditions, but some general rules may be found helpful when using from 18 to 25 in. blast pressure in the ash pan. The length of the blow and run should be longer with coal than with coke. The writer is partial to a 3-minute blow and 5-minute make with coal and 2-minute blow and 4-minute make with coke when making about 24-candlepower gas. With higher candlepower it is advantageous to lengthen the "make." With some coke a very high (35-in.) blast and a 2-minute blow will often melt down the wall clinker with very favorable results. Very often the change in the blow or run, or both, will improve things, simply because the fuel is better adapted to longer or shorter blowing or running periods.

When 1 lb. of carbon is burned to CO it gives up 4,350 B.t.u.; when this CO is burned to CO_2 it gives up 10,190 B.t.u. The checker brick of a set is heated from the sensible heat of the gases, leaving the generator and the heat of combustion from the CO gas passing over from the generator. Therefore, the most economical balance is reached when the minimum amount of CO required to heat the checker brick is allowed to leave the generator, all the rest of the CO being burned to CO_2 in the generator.

This condition is more easily obtained with high blast pressure, say 35 in. in ash pan. The only way this condition can be approached with low blast is to carry a thinner fuel bed, but this can only be carried out to a small extent before blow holes show in the generator, with their resulting greater losses.

(8) Grate Bar Spacing Too Wide

It is important to examine the grate bar spacing, especially with an old set, for the gradual wearing away and rounding of the grate bar corners, while not in-

creasing the proportion of air space, does allow more ashes per M. to fall through them. The ash should not run over 6 lb. per M., while 4½ lb. is very good.

(9) Steam per M. too High or Too Low

The steam used per M. has already been partly covered, but it is well to refer to good past results to see how the steam per M. and per minute compare; also the other operating conditions, especially the kind of fuel being used. Remember that each extra 7 lb. of steam per M. means about 1 lb. extra of boiler fuel per M. unless the gas make increases to offset it.

(10) Change in Fuel Used

Frequently a change in kind of fuel used is the cause of the trouble. By referring to some past results when using the same fuel and comparing the operating conditions, one is greatly helped.

(11) Coal Very Fragile and Cracks Up

Fragile coal is a frequent cause of poor coal results. It will show a good analysis, high in carbon, but very poor fuel results; the make and oil efficiences are also lowered. The coal will not stand high blowing, high steam per M. or high blast, for it is easily broken up. This is most readily discovered by watching a clean-out and by looking at the top of a generator just before making a run.

(12) Sets Charged Unevenly or Not to Proper Level

It frequently happens that much better fuel results are obtained by carrying the fires a little lower (especially after cleaning) than usual, though sometimes it will sacrifice the make a trifle. Under some conditions, on the other hand, fuel results may be greatly improved by increasing the depth of the fuel bed. The importance of carrying the fires uniformly level is obvious, for the general tendency is to cone the fire in the center and, as the wall line is then the course of least resistance, the currents of air and steam tend to by-pass the center of the fire. Some operators even use fine fuel around walls or ram down the outside edge of the fuel after cleaning or coaling, while others have placed an 18-in. diameter perforated pipe in the center above the bars, reaching up into the fuel bed to offset this tendency.

This pipe is connected to the air and steam supply, and is made of special metal to withstand the heat. However, it greatly interferes with the proper cleaning of a fire and is not to be recommended.

(13) Atmospheric Changes, Such as Humidity and Barometer

There is no question that the higher the humidity the more aqueous vapor is carried into the ash pan with the air, causing a subsequent loss of heat in the fuel bed. Some blast furnaces have reduced this loss of heat by passing the air first over cooling coils and then heating it up before it enters the furnace. Sudden changes in the barometer will often show an apparent gain or loss in results, which is due simply to the gain or loss in gas metered, as the gas may not be corrected for barometer at the station meters.

The change of 1 in. in barometer in a day is common, and makes a gain or loss of 3 1/3 per cent in the make, with an apparent gain or loss of about 1 lb. of generator fuel and 0.13 gal. of oil (when using 4 gal. per M.); and this is quite misleading, especially when one is experimenting in an effort to improve results.

(14) Careless Operating of Set

Careless operation of sets plays a much larger part in manufacturing results than is generally realized by the superintendent.

The gas maker is a very big factor in the attainment of good results. With recording steam gauges and pyrometers, the gas maker is under more or less constant check; still, careless or indifferent operation is difficult of detection.

Marked improvement in results invariably follow when the gas maker is acquainted with the hourly as well as the daily operating figures.

The writer believes that it is essential to good operation to have hourly figures posted so that the gas maker can see them. He soon learns how to associate certain conditions of the set with good and poor results. He gets much more interest out of his work, and, above all, this new interest keeps him in a better frame of mind.

(15) Too Much Blue Gas Wasted at Stack

Wasted blue gas indicates that the generator is producing more producer gas than is necessary to heat the fixing chambers, and usually it is accompanied by poor fuel results. If so, the steam balance or cycle of runs and blows is not correct and needs adjustment. Sometimes it occurs when running lower oil than usual; and, provided the fuel results do not suffer, there is, in this case, no need for adjustment, as it is better to waste blue gas than to temporarily upset the balance of the set.

(16) Leaky or Dirty Hot Valves

It is very plain that great loss in efficiency takes place with a hot valve that leaks and allows some of the blast and steam to by-pass the fire. Valves should be carefully inspected before starting up a set, and repaired when necessary. When operating, it is helpful to place some signal or gauge, such as a clamp, on the rack of the hot valve, so that if it is dirty it will be seen at a glance.

(17) Irregular Charging or Cleaning

Irregular charging or cleaning are frequent causes of poor results, for it is important that a set be cleaned and charged regularly. A set which runs two hours over its cleaning time will not only drop in its gas make, but the fuel and oil results are proportionately affected. It is important to have the cleans distributed evenly over the twenty-four hours so as to insure a steady hourly make, and consequently less changes of the oil per run and hence more uniform heat conditions.

(18) Sets Not Run on Correct Time

This is not an infrequent occurrence and, though recording steam gauges are a check to the gas maker's

operations, it is very difficult to find small irregularities, the moral effect of recording gauges being the best influence. Clocks should have large dials and located conveniently near the gas maker.

(19) Steam Gauges Incorrect and Steam Not Measured Accurately

Steam gauges should be tested at least once a month, for one which is only a few pounds out makes a great difference in the steam delivered. The method of measuring steam should be as accurate as possible.

(20) Unnecessary Delays When Cleaning

Unnecessary delays when cleaning cause certain losses and should be avoided. When the cleaning doors are kept open for a longer time than necessary, the natural draft causes a loss in fuel. The heats in the sets get too high, resulting in subsequent loss in oil results. This trouble can be modified by closing the stack valve and opening the coaling doors when cleaning.

(21) Leaky Steam Valves

Occasionally a leaky base steam valve will keep the fuel high, due to the fact that the leak of steam keeps the fire soft. It is often noticed first by accumulated water in ash pan at cleaning time. If it is bad it is easily noticed when coaling up or when the ash pan doors are open.

(22) Changing Fuel from Coke to Coal

When changing fuel from coke to coal there is (for the first day only) an apparent increase in the generator fuel. This is not really true, as it is due to the inaccuracy in figuring, as usually no account is taken of the stock on hand in the generator, which is assumed to be the same, when actually it has increased about twice in weight. When changing from coal to coke the reverse takes place for the first day.

(23) Shutting Down and Starting Up

Irregular starting up and shutting down of sets immediately shows in the form of high fuel, for the idle machines are often full of coal. When a set is dropped for repairs, especially after a set has been cleaned and filled up with coal, the fuel will show high.

(24) Irregular Operation of Hot Valves

Irregular operation of hot valves occurs sometimes when making split runs. It causes irregular up and down steam, depending on how irregularly the valves are operated.

(25) Coal and Coke Not Mixed Properly

When using a mixture of coal and coke it often happens that the coal and coke are conveyed in different cars, and when it is delivered into the generator it should be well mixed so that all the coal will not be on one side of the generator and the coke on the other. This would give less resistance to that part of the fuel bed where the coke was; most of the blast and steam would go that way, finally resulting in blow holes or "black eyes."

(26) Irregular Results on Day and Night Shift

When keeping separate night and day fuel figures, if one shift shows much higher than the other it may be caused by one shift leaving the fires very low so that the next shift has to fill them up. This irregularity spells inefficiency. If after cleaning a set it is blown much longer than it is scheduled to blow, hotter fire results and higher gas make, but at a terrible sacrifice to the oil results, as the checker brick is coated with carbon, causing immediate as well as subsequent losses.

(27) Low Oil per M

If the oil per M. is reduced to any extent it has a noticeable effect on the generator fuel. As about one-third of the gas comes from the oil, when using 4.40 gal. per M., if the oil is reduced, say, from 4.40 to 4.00 gal. per M., that means a loss of 10 per cent in the gas from the oil, or 3 per cent loss in the total gas made, and 3 per cent increase in the generator fuel per M. There is, of course, a slight saving in the heat required to vaporize the oil when using less oil, but this effect is almost negligible compared to the reduced volume of oil gas. Therefore, when comparing the capacity and fuel per M. of different plants a correction should be made for oil per M.

(28) Wet Steam

Occasionally wet steam will cause a loss in generator fuel efficiency. It may be due to high water in the boiler, faulty steam line construction, or to the fact that the boiler room is far removed from the generators. It is good practice to have a steam separator in the steam line to each set to avoid this trouble.

(29) Inaccurate Meter Registration

Of course, any inaccurate meter registration will cause incorrect results, and it is very important in times of trouble to examine the meters. Before looking up meter trouble always note whether all results seem poorer than usual and all in about the same proportion. If only the fuel per M. was high and all the other results normal, it would not look like meter trouble. Very often a small by-pass valve may be leaking, or some small line may have been left open by mistake.

Meters should be tested once a year with a test meter.

A quick, rough, simple test is to gradually open a meter and note how much opening is required before the drum starts to move. Any serious leak in the drum will show up at once. Also it is well to note whether or not the gas made is properly corrected for temperature and pressure, and whether you get the true pressure from the recording chart at the meter inlet.

It is well to check up the thermometer once a year, for they sometimes vary with age. See that the thermometer is placed on the outlet instead of the inlet pipe of the meter, for there will often be a difference of 5 deg. between these points, which affects the volume of the gas 1 per cent. As the water is often colder than the incoming gas, it seems that the outlet temperature is nearer the temperature at which the gas is measured.

(30) Inaccurate Scales or Fuel Inaccurately Weighed

The scales on which the generator fuel is weighed should be balanced once a day and tested once a month by one competent to do so. The coal cars should be weighed now and then, as they change in weight, due to repairs, accumulation of dirt in the small pockets or between the false bottoms (when using a car with renewable bottom). The man weighing the coal should be checked now and then. A new man at the scales will often prove to be the cause of all the generator fuel trouble. A good check to the weighmaster is the gas maker's report showing the number of cars used.

(31) Clerical Errors in Office

Of course, no one is infallible and it is necessary to check up the man who works out the daily figures, especially if he is not thoroughly familiar with the work, the most common errors being caused by a transposed figure or a mistake due to not making proper adjustment for filled cars on hand or on operating floor from day to day.

(32) Steam and Blast Pressure Irregular at Blowers or at Individual Sets

It is imperative to have recording pressure gauges in the engine room so that the engineer can keep in touch with the blower pressure.

Irregular blower charts are usually coincident with poor efficiencies, especially high generator fuel, due to irregular blasting. Irregular pressure charts may be due to not having the sets paired off properly and "in step."

Due to faulty blast main construction, or possibly to a blast damper having been partly closed by mistake, it sometimes happens that even with regular blast pressure some individual sets do not get their share of blast. When using the air meters, such irregularities are detected immediately.

In this connection, it is well to mention that when using belted blowers sudden changes in weather will tighten or loosen belts, causing higher or lower blast pressure; therefore, the blower speed or the generator steam should be adjusted to meet the changes. Similarly, steam irregularities at initial points at individual sets often occur and should be checked up.

Steam pressure gauges with larger dial spacings are not only easier for the gas maker to read but tend toward greater accuracy. The use of such devices as air and steam meters, pyrometers, etc., or anything that tends toward uniformity or regularity of operation, certainly increases the efficiency of operation.

Oil Troubles

Now, having carefully gone over the list of possible fuel troubles and noting the improvement in results through the application of this method, we will next proceed to look for the oil trouble by checking each item as given below:

(1) Generator fuel bed conditions.
(2) Heats in carbureter and superheater.
(3) Streaks in carbureter.
(4) CO_2 too high.
(5) Conditions of checker brick.
(6) Photometer irregularities.
(7) Poor oil.
(8) Irregular running of set.
(9) Atmospheric changes.
(10) Temperature of the purifiers.
(11) Temperature of condensers.
(12) Incorrect or careless rechecking of sets.
(13) Cold fresh water on the wash box.
(14) Generator cleaning door open too long while cleaning.
(15) Temperature of the pre-heated oil.
(16) Nitrogen too high.
(17) Leaky or dirty hot valve.
(18) Irregular coaling and cleaning.
(19) Exposed shaving scrubbers.
(20) Clerical errors in office.
(21) False oil tank measurements or leaky tanks.
(22) Incorrect meter registration.
(23) Incorrect temperature and pressure correction for same.
(24) Leaky by-pass valves in meter house, etc.

(1) Generator Fuel Bed Conditions

Fuel bed condition is frequently the cause of poor oil results, though as a rule it is a fact not appreciated. The generator fire is so closely associated with the oil results that it is impossible for the fuel bed condition to change without having a marked effect upon the oil results. This is so often shown when changing to a better grade of generator fuel. An improvement in oil results is frequently noticeable when changing from coke to coal. Part of this is due to lower CO_2, but the fuel bed condition has the greatest influence.

(2) Heats in Carbureter and Superheater

This is another vital factor that affects oil efficiencies. The problem is a big one, and it is impossible to say what heats should be used, for it depends upon the grade of oil used, the candlepower required, the capacity at which the set is run, and the conditions, atmospheric and otherwise, to which the gas is subjected on its way to the testing station.

A general rule is to run the carbureter outlet about 100 deg. Fahr. hotter than the superheater top, and to carry the superheater from 1,200 to 1,400 deg. Fahr., according to local conditions.

It is the writer's opinion that the recording and not the indicating pyrometer is the best guide to proper heat regulation in a set. The straight line thermo-electric recording pyrometer is the most satisfactory, and an instrument of this type placed in the average water gas set will pay for itself in a few months.

While on the subject of pyrometers it is important to note that this instrument is as delicate as it is useful, and that it is important to take proper care of it. For if not properly cared for it will soon be useless, and, what is worse, you will always be prejudiced against the most practical as well as most scientific method of increasing oil efficiency.

The pyrometer should be protected by an extra heavy dustproof box with glass doors, through which it can be easily seen by the gas maker.

The effect of the pyrometer on the gas maker is usually exactly the opposite to what is expected. Instead of looking upon it as a watchman, the gas makers take a healthy interest in it, each man competing with his neighbor to make the best chart. The personal interest taken is usually such that a gas maker, of his own free

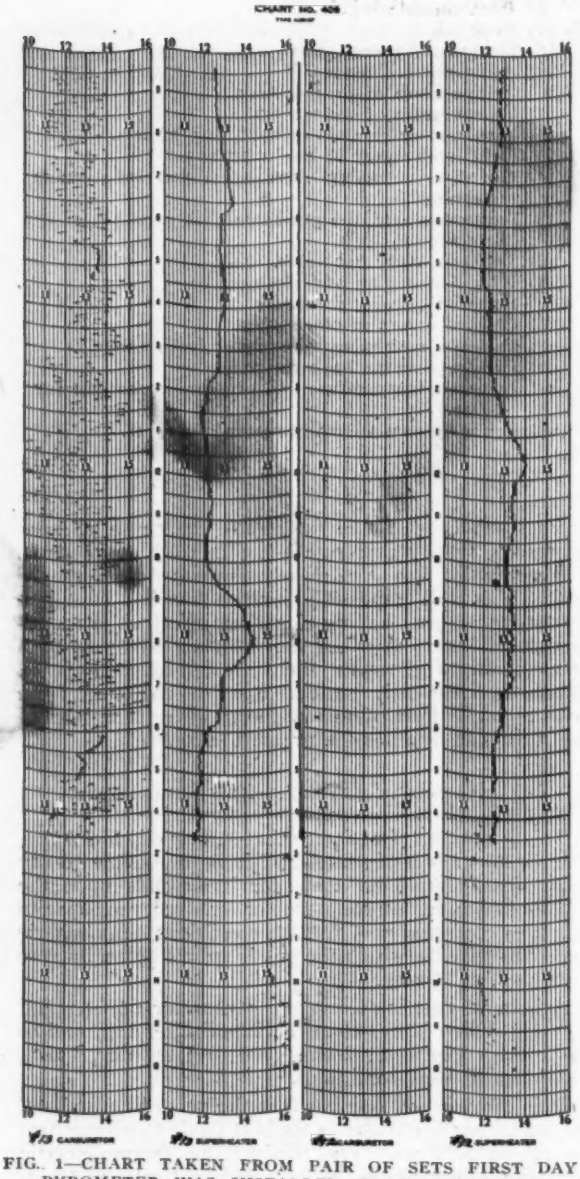


FIG. 1—CHART TAKEN FROM PAIR OF SETS FIRST DAY PYROMETER WAS INSTALLED—HEATS RECORDED IN HUNDRED DEG. FAHR.

will, severely holds his relief man to account for his chart. The straight line chart is very superior to the circular chart, as it is so much easier to follow with the eye and makes a comparison from chart to chart much simpler.

One glance at the straight line chart tells more than a five-minute study of a circular chart. Fig. 1 shows a chart taken from a pair of sets the first day a pyrometer was installed. Fig. 2 was taken a few days later. The difference is very great, especially as no word was said to the gas maker about improving the record. Fig. 3 shows a chart taken a few months later, following the order to show better charts.

You will note that all efforts were made to keep the superheater temperature steady by sacrificing the carbureter heats when necessary. The temperature of the superheater has the most effect upon the gas, as is shown by stain papers.

The pyrometer box should be kept locked and the charts only changed by a person of intelligence. It is also desirable to have a skilled mechanic to familiarize himself with the instrument to make minor repairs and adjustments. He should have a special tool box just for the pyrometer parts, and he should be expected and allowed to give a reasonable amount of time to the work. It is necessary to give reasonable care and attention to this instrument, and if you do not intend to do so, then do not buy a pyrometer.

The improvements due to the pyrometer manifest themselves first and principally in a marked savings in oil per M. with a much better condition of checker work and take-off pipes, with a saving in checker brick and labor. The life of the oil sprays is materially increased. Next to the pyrometer, the stain paper tests taken at the wash box outlet are the best guide. If they are taken conscientiously they are a great help to the operator. If taken in connection with a pyrometer they are also most useful, as a stain paper shows the combined results of the oil and heat, while a pyrometer only shows a heat record.

In connection with heat regulation in a set, an interesting method of analyzing the heats is to plot a series of curves, as shown in curve No. 8 in the accompanying illustration. These curves were obtained from a Lowe set, and the observations were taken almost simultaneously by rapidly operating a rotary switch in connection with an indicating thermo-electric pyrometer The observation points were located as follows:

Point No. 1—At the lower hot valve connection.

Point No. 2—At upper hot valve connection.

Point No. 3—At the third course of brick from the top in the carbureter.

Point No. 4—At middle (or seventh) course of carbureter.

Point No. 5—At the third from the bottom course of the carbureter.

Point No. 6—At the connection between the carbureter and the superheater.

Point No. 7—At the third course from the bottom in the superheater.

Point No. 8—At the middle of the superheater.

Point No. 9—At the third course from the top of the superheater.

Point No. 10—At gas take-off from top of superheater.

The points 3, 4 and 5, being very close together, appear to be out of proportion to the points; but when the actual linear travel of the gas is measured from a drawing it will be found to be approximately correct.

A study of heat curves taken in this manner will give valuable information when designing future water gas sets, besides being helpful for operating conditions on the following points:

How much of the work is being done in each chamber?

How much temperature fluctuation takes place from blow to blow, from coaling to coaling, from clean to clean, and from beginning to end of run?

The great difference in the heat effects from up and down runs.

(3) Streaks in Carbureter

Black streaks in the carbureter are a very common trouble. It is usually noticed when a machine comes off dirty (showing oil vapors after coming off the run), and it is nearly always due to a defective oil spray. A streak can usually be seen through the carbureter sight cock, but not always; if a streaky carbureter is seen or suspected the oil spray should be taken out and examined. While taking out the oil spray you will often see the streak by looking down the oil spray hole.

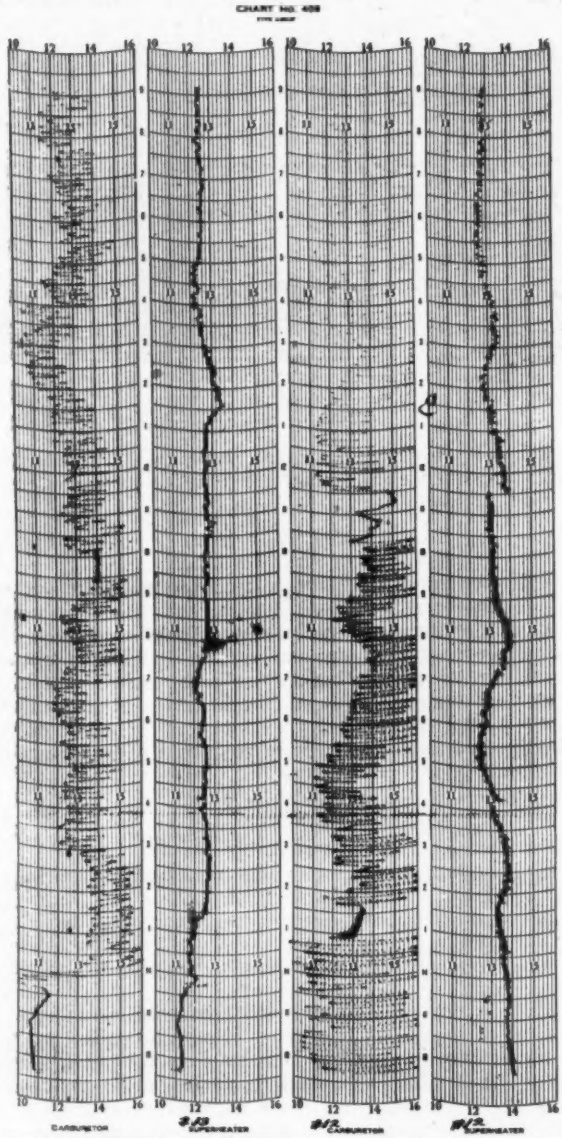


FIG. 2—BENEFICIAL RESULT OF PYROMETER INSTALLATION—THOUGH NOTHING WAS SAID TO GAS MAKER ABOUT IMPROVING THE RECORD, CHART TAKEN FEW DAYS LATER SHOWS MARKED DIFFERENCE TO THAT IN FIG. 1

Should the brick on top of the carbureter appear badly broken up and packed over-tightly so as to form a compact mass, this will be a cause of the trouble and the set should be let down at once and recheckered.

(4) CO_2 Too High

One per cent of CO_2 in the gas lowers the candlepower 0.8 of a candle; therefore, if X equals the price of oil and 4 gal. is being used per M. to produce 24-candlepower gas, then $\frac{4X}{24}$ equals price of 1 candlepower.

One can easily determine what is the cost of the loss in candlepower caused by an increase in CO_2 resulting from a change in operation and if the improvement in the other items of cost by said change in operation offsets the loss through drop in candlepower.

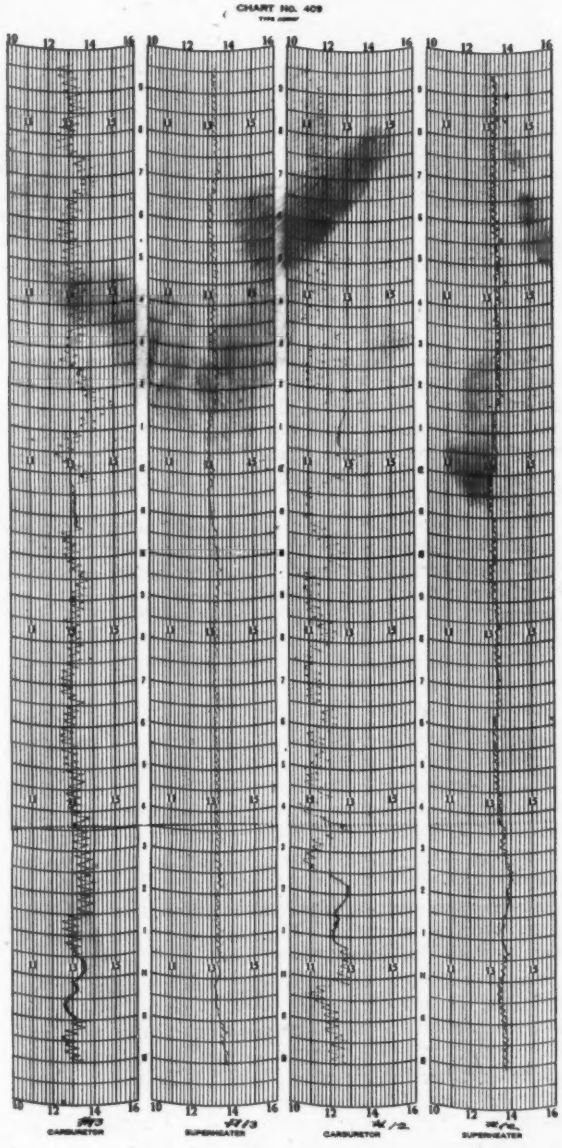
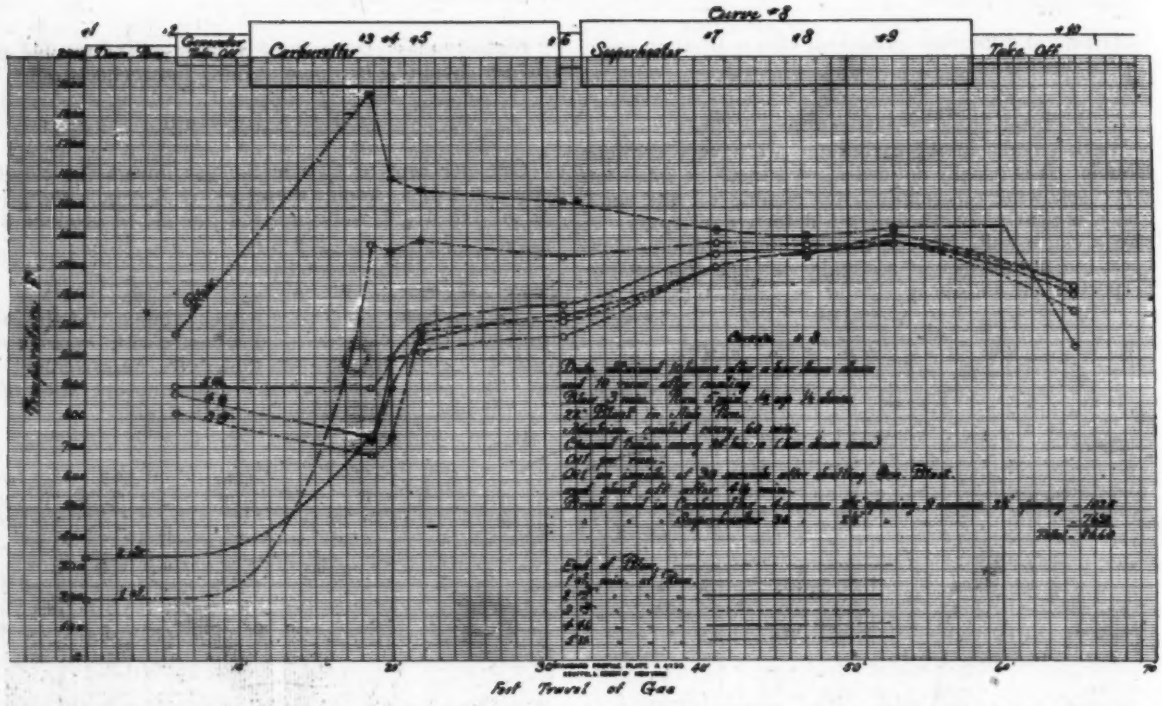


FIG. 3—CHART TAKEN FEW MONTHS LATER, FOLLOWING ORDER TO SHOW BETTER RECORDS



AN INTERESTING METHOD OF ANALY ZING THE HEATS IS TO PLOT A SERIES OF CURVES SIMILAR TO THE ABOVE

(5) Conditions of Checker Brick

The condition of the checker brick has a very important part to play in oil efficiencies. The writer believes under ordinary conditions the carbureter should not be run over 800 hours, or about thirty-three days, but the superheater can be run twice that time. The amount of extra labor to rechecker the set is easily offset by the saving in oil.

The condition of the checker brick should be observed each time a set is let down for rechecckering. It is very encouraging to note the great improvement in the checker brick after installing and operating a pyrometer.

(6) Photometer Irregularities

As the candlepower per gallon figure bears a direct relation to the oil per M. results, it is always important to check up the photometer room and its equipment.

It is desirable to have the candlepower standardized as far as possible by passing the gas through a cooling coil set at a definite temperature, otherwise the candlepower has little significance from day to day or when comparing one plant with another.

When examining a photometer room the following points should be noted: The size and proportion of room and its ventilation.

When examining the apparatus check up the system for leaks, test the meter and note its water level (with gas pressure off). Note the position of the standards and test the lights and clean the sight box, examine its pointer and see that it is not bent. Note whether the gas line coming into the room is exposed to low temperatures. If so, cover it with hair felt. See that the line is properly pitched and that the drips are ample and that they are drawn off regularly. Examine the gas tip; if necessary clean it out or put in new one.

(7) Poor Oil

A poor grade of oil necessarily increases the oil per M. A poor grade of oil, meaning an oil with a small per cent of the necessary light-giving hydrocarbons, will give poor results. Also an oil with a high per cent of residium present (other things being equal) will give poor results. A study of the distillations gives little help except that it shows a change in the grade of oil being used, and this oil may require different heats in the sets.

(8) Irregular Running of Set

Careless running of a set always reduces its efficiency when the proper interval of up and down runs is not observed, and if the oil is run irregularly poor results are bound to follow.

(9) Atmospheric Changes

It is true that sudden changes in atmospheric temperature are accompanied by changes in candlepower, and in cold weather more oil is required to deliver a given quality of gas at a certain point than in warm weather.

One also notices that on the first suddenly cold day more oil is required than during the cold days following. The reverse takes place when a warm day follows a cold day, as much less oil is required than usual. There seems to be a "lag," or what may be called a candlepower saturation point for different temperatures.

(10) Temperature of the Purifiers

Low temperature in purifiers (under 90 deg.) will not only affect the oil condition, but also retard purification.

(11) Temperature of Condensers

The loss of some of the valuable sensitive hydrocarbons through their absorption by the heavy tars is often caused by low temperature at the condenser.

It is difficult to set a definite temperature for the condenser outlet, for it depends upon outside temperatures, local conditions, etc.; but a general rule is to regulate it so as to deliver the gas to the station meter between 75 deg. and 85 deg. Fahr., allowing as much condensation to take place in the relief holder as possible. Aside from the more gradual condensation of the gas, there is the saving of the extra steam required for pumping water to the condensers. It is very desirable to have the condenser water regulated by a thermostat so as to avoid extreme temperature variations.

(12) Incorrect or Careless Recheckering of Machines

The recheckering of sets should be superintended by one of intelligence, and not left to ordinary labor.

The spacing found to give the best methods is 2½ in. throughout, except the three top courses of the carburetor, which should be 3-in. spacing.

The size of the spacing bears a direct relation to the gas make, as the larger the spacing within certain limits the more air passes through the fire, and hence the larger is the gas make.

(13) Cold Fresh Water on Wash Box

At times when a seal is lost on a set it is necessary to put cold water on the wash boxes. This condition should be avoided as much as possible, as it has a very deteriorating effect on the candlepower of the gas, due to the absorbing or condensing of some of the illuminants.

(14) Generator Cleaning Door Open Too Long While Cleaning

While cleaning the generator fire the natural draft tends to raise the heat in the superheater. If the period of cleaning is lengthened to any extent, the steady climbing of the superheater temperature is very serious; for not only is there a loss in the first oil used after cleaning, but, what does more harm, a permanent loss in the efficiency of the checker brick resulting from the lampblack deposited upon the bricks.

Closing the stack valve and opening the generator coaling door while cleaning will greatly help to maintain steady superheater temperatures. If the first blow after cleaning is also made under the above conditions, it will be found that the superheater temperature will not go up so high.

(15) Temperature of Pre-heated Oil

There is a difference in opinion as to whether there is anything to be gained by heating the oil. After a series of tests made on an experimental oil spray at different speeds and temperatures and different nozzles, etc., I have come to the conclusion that the oil may be heated to advantage up to the point where it begins to vaporize; beyond that point (due to the generation of gases from the oil) unsatisfactory spray operation usually results.

(16) Nitrogen Too High

Nitrogen being a neutral gas, any excess causes a loss in candlepower. The excess nitrogen is usually found to originate in the air put in for purification, in the air from leaky blast valves or through the practice of opening the blast valve before opening the stack valve, in taking off a run in an effort to get that portion of the gas left in the set.

When one deducts the volume of the checker brick from the total volume of the set, and then corrects the remaining gas for temperature, one will see that there is very little to save and that in the saving there is always the increased liability of an explosion in blast main.

(17) Leaky or Dirty Hot Valves

It is evident that if a hot valve leaks, due to a defect or the existence of dirt under the seat during the gas-making period, there is a certain loss in the oil efficiencies, due to the steam leaking by and lowering the brick temperatures. The fact that the gas make is lowered by this same cause also makes an indirect loss.

(18) Irregular Coaling or Cleaning

Irregular coaling and cleaning affects, directly and indirectly, the general operation of the set, and hence the oil efficiencies. For instance, if a set is allowed to run too long between coaling the heats go up too high, and if the set is allowed to run too long before cleaning the make will fall off, and with it the oil efficiency.

(19) Exposed Shaving Scrubbers

The shaving scrubber in cold weather, when not protected from the elements, has quite a deteriorating effect upon the candlepower. It seems reasonable that at all times there is more or less absorption of the light hydrocarbons from the gas by the steady flow of heavy tar and water. This condition is greater in cold weather and is aggravated by allowing the shavings to get fouled with heavy tar.

(20) Clerical Errors

As in the case of poor fuel results, the clerical work should be periodically checked.

(21) False Oil Measurements or Leaky Tanks

With large oil tanks it requires only a small error in measurement to give distorted oil figures per M. When using gauge glass measurements, it is a good practice to blow out and clean the gauge glasses on the tank regularly. A general oil meter between the pump and the operating floor is a good check for the tank. A leaky tank is always a possibility. It is well to check up the oil meters with the tanks.

RESULTS

Date	Air Temp.	Oil per M	Oil Grav.	Heats in set	Candle Power Water Gas	Candle Power Station Gas	C. P. per Cal.	Grav. of Tar	CO_2	Ill.	Equiv. fuel Coal	Equiv. fuel Coke	Equiv. fuel Total	% of coke	Make per Sq. ft.	Blow & Run	Blast Pressure	Ashes per M.	Schedule of runs	Anthracite Surg'n
1																				
2																				
3																				
4																				

These figures are averaged each week and month, and the corresponding average of the previous years are placed above them for comparison.

FIG. 4—A MOST HELPFUL GUIDE TO INTELLIGENT OPERATION

(22) Incorrect Meter Registration

The registrations of the station meter should be checked also, as stated in the investigation of poor fuel results.

If fuel, make and oil results are all poorer than usual, and to the same extent, it is generally fair to assume that it is the meter which is causing the trouble.

(23) Incorrect Temperature and Pressure—Correction for Same

Incorrect temperature corrections will, of course, affect the make, oil and fuel results.

(24) Leaky By-pass Valves in Meter House, Etc.

A leaky by-pass valve is a possibility, as stated under causes of poor fuel results.

There are several general rules which should be observed in connection with the use of the above list of causes of poor fuel and oil results, namely:

Do not make changes too rapidly. One seldom shows improvement under rapid or too frequent changes, and, what is much worse, the knowledge gained from experimenting is lost and you soon find yourself bewildered and discouraged. Important changes, such as change in cycle of run and blow, should be allowed to stand several days. Small changes, such as steam adjustment, should be allowed to run one or two days.

If general results are better than usual, do not make any change whatever, for changes which seem logically correct often cause indirect effects which offset the first change, and the balance in the set is lost. Do most experimenting when results are not at the best. That does not mean to be unprogressive, and the writer does not want to be misunderstood in this point; but he has found that the best average results are obtained by following this rule. During the period of good results the greatest effort should be directed toward observing under what conditions these results are being obtained, as these observations are valuable for future reference.

Any condition of steady running, such as the same number of sets running each hour, the same interval from clean to clean in each set, etc., tends toward better results. A steady rate of production minimizes accidents and wear and tear on machinery.

As a general rule, split runs give better results than straight up and down runs separately. Also, when making split runs with coke it is better to go on with the up run for about the first quarter, then down for about two quarters, and then up again for about the last quarter of the run. It results in larger makes and lower CO_2. With coal, the first half of the run should be down and the last half up.

Remember that the generator is the heart of the set and nearly all the trouble, directly or indirectly, emanates in the fuel bed. So in endeavoring "to get right," first get the make and fuel per M. right, and then go after the oil results.

It often happens that good fuel or oil results are obtained at a sacrifice, one of the other, or some other item of the fuel cost. It may happen that good fuel results are obtained with high CO_2 and high nitrogen, at a sacrifice of the oil results. Sometimes good generator fuel results are at a sacrifice of the boiler fuel by using very high steam per M.; again, good oil results may be obtained at a sacrifice of the labor when the set is run at too low a capacity, or low labor results may be obtained at a sacrifice of the oil and fuel results when operating at high capacity.

In this connection a most helpful guide to intelligent operation is the form given in Fig. 4. If this sheet is filled out and studied daily it will prove itself a potent factor in water gas economy.

With Proper Mechanical Devices Country Could Probably Get Along With Half as Much Coal as It Is Using At Present

Van H. Manning Points Out That It Is No Longer Cheaper to Waste Coal Than to Educate Firemen—Need of Bringing Home to the Householder That Every Shovel of Anthracite He Passes into Furnace Is Equivalent to Half a Pound of Sugar, Half a Loaf of Bread or a Pint of Milk

The economical use of fuel has proved to be no simple problem, declared Van H. Manning, director of the U. S. Bureau of Mines, speaking to a representative gathering of men who are to assist the Fuel Administration in the different States. The coal, the equipment and the human variables make hard-and-fast general rules impossible. The Bureau of Mines has carried on extensive experiments to determine the fundamental principles of the combustion process and of furnace design, and at the same time has been making practical application of improved practice in Government power plants. Many publications are available which show the progress of the work along these lines.

Americans have been as wasteful of coal as of other resources, largely because coal has been abundant. To many consumers it has seemed hardly worth while to give time and thought to the saving of coal.

Consumer Must Give Serious Consideration to Problem Which Confronts Country

Conditions have suddenly changed. To-day it is everybody's business to save coal. Coal is the foundation stone of industry. Without it the production of equipment for war must halt. Transportation facilities must stand still. One man's careless and wasteful use may mean an idle factory or a cold house for his neighbor. With the world looking to us largely for its coal supply, with increased demands at home, with a scarcity of available labor, with overtaxed transportation facilities, the con-

RECORD OF MANUFACTURING, RESULTS & COSTS — COSTS — JANUARY 1917

Boiler Fuel							Generator fuel			Boiler fuel								
Coke Sorgs	Slack	Buck.	Tar	Fuel Oil	Coke Breeze	Total	Oil	Coal	Coke	Anthr. Coke Total	Sorgs.	Slack	Buck.	Tar	Fuel Oil	Coke Breeze	Total	Material	Labor	Material & Labor	Remarks

sumer of coal must pause and give serious consideration to the problem which confronts the country.

If the consumers can be aroused to an intelligent consideration of the burning of coal, they can begin to save 10 per cent of the production (600,000,000) at once. With more effort, through instruction and a moderate remodeling of coal-burning equipment, which could all be accomplished during the war, a further considerable saving can be made.

The possible coal saving, when present practice is compared with the best ideal practice, is very large. If it were possible to supply the need of this country for light, heat and power through the highest type of mechanical devices, and it we could make a skilled coal user out of the average user, we could probably get along with half as much coal as we are now consuming. This ideal is far beyond present realization.

The immediate problem is a difficult one. We cannot scrap all out-of-date power plants. We must start by doing the best with what we have. We must begin saving coal at once. The problem is personal. It deals with the human element. We must reach the man with the shovel.

250,000 Firemen Shovel 60 Per Cent of All Coal Used

About fifteen million people shovel the 20 per cent of our coal used for domestic purposes. Only about two hundred and fifty thousand firemen shovel the 60-odd per cent of our coal used by power plants and railroads. While we must appeal to the householder to save coal, it is vastly more important to reach the fireman, through whose hands the larger part of our coal passes.

The householder must realize that when he throws a shovelful of anthracite coal into his furnace its value is equivalent to half a pound of sugar, or half a loaf of bread, or a pint of milk. He must appreciate that it is worth while to examine his house and to overhaul his heating equipment. Weather strips, double windows, pipe coverings, clean flues and chimneys, and tight fittings in ash-pit, doors, dampers and furnace parts will all pay. Damper control is one of the chief secrets of economical heating. Clean surfaces are most essential, as soot is a poorer conductor of heat than asbestos. Care, attention and taking pains will be the greatest factors in saving domestic coal.

No Longer Cheaper to Waste Coal Than to Educate Firemen

The fireman is, however, the biggest single factor to be considered in a campaign to secure the largest saving of coal.

Many manufacturers have made a serious mistake in failing to consider the fireman as a skilled worker. Too often he is treated as a roustabout. He is not instructed nor given proper labor-saving devices.

As coal increases in price, or becomes difficult to get, the fireman handles more and more of his employer's money. His efficiency means more in dollars and cents. This is an encouraging feature in the situation. It means a better recognition of the importance of the fireman, more efficient work on his part, and a consequent increased saving of coal.

The viewpoint is changing. It is no longer cheaper to pay for the coal than to educate the fireman.

In carrying out a campaign to promote the saving of coal, let the appeal be made to the householder to cut down his consumption in every way possible; but, above all, give serious consideration to methods by which a systematic relationship may be established between the office and the fireman.

Encourage the manufacturer to take a keener interest in his fuel consumption and to back up his fireman by giving him the best information and equipment available.

This problem has two phases—first, to arouse the interest of the manufacturer and his engineer and fireman and to point out the part which they can play in relieving the present crisis in coal supply; second. to furnish whatever technical information may be desirable and which will be immediately applicable to accomplish the result sought.

Preventing Flash Back in Automatically-Controlled Gas-Fired Tubular Boilers

One of the most serious drawbacks to using an automatic control on a gas-fired tubular boiler has been its tendency to flash back at a point when the control is about to close the gas valve and the pressure is low, declares A. M. Powell, heating and industrial engineer of Los Angeles, Cal., in a suggestion submitted to the Wrinkles Department, D. J. Young, editor, of the Pacific Coast Gas Association. This is especially true of large installations when large ports and air mixers are necessary.

To overcome this I have found it convenient to use slip shield mixers, and by a simple arrangement connect them to the automatic control so that as the control closes the gas valve it also closes the shield over the air mixer, and vice versa, as the control releases it opens the air mixer. This has worked very satisfactorily on a number of installations.

Spent Oxide as a Weed Eradicator

The disposition of spent oxide has been in years past some considerable consideration, declares M. G. Hall, manager of the Pacific Gas & Electric Company, at Santa Rosa, Cal., in the Wrinkles Department of the Pacific Coast Gas Association. Our people have taken means to save the sulphur; however, in small plants it is hardly worth the while. Last fall I had considerable spent oxide to dispose of, and it is also necessary every year to hoe the grass from around our high-tension poles. It struck me that I might dispose of my spent oxide and also get some benefit from it, so I had it spread around the high-tension poles between Santa Rosa and Sebastapol and Santa Rosa and Cotati, giving it a radius of some 3 ft. around the pole. The spent oxide kills the grass and this year I will practically have no grass to hoe. Some weeds, such as dock, which has a large bulbous root and is a perennial, are not completely killed.

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CONTENTS

GENERATOR THE HEART OF THE WATER GAS SET, AND NEARLY ALL TROUBLE, DIRECTLY OR INDIRECTLY, EMANATES IN FUEL BED. BY C. H. HODGES..... 441

WITH PROPER MECHANICAL DEVICES COUNTRY COULD PROBABLY GET ALONG WITH HALF AS MUCH COAL AS IT IS USING AT PRESENT.... 450

EDITORIALS 452

UTILITY DOES NOT RECEIVE A FAIR VALUATION WHEN COST OF PHYSICAL PROPERTY ALONE IS CONSIDERED..... 454

HOW THE GAS COMPANIES ARE HELPING THE NATION 455

MERCHANDISING GAS 457

LACK OF SELF-CONFIDENCE THE GREATEST HINDRANCE TO SUCCESS..... 457

MERCHANDISING GAS CONTINUED ON PAGE 16 OF THE ADVERTISING SECTION.

NEWS OF THE GAS INDUSTRY..... 461

SOCIETIES AND ASSOCIATIONS..... 463

PERSONAL NOTES..... 464

CONSTRUCTION NOTES..... 464

Economies in Water Gas Manufacture

It is a peculiar condition of the field of gas journalism that, while the ins and outs of distribution, of sales, of utilization, etc., have been discussed and rediscussed many times over, it is but seldom that anything worth while is published on manufacture. The AMERICAN GAS ENGINEERING JOURNAL has had this condition called to its attention many times, and has made energetic efforts to overcome it.

For one reason or another it has seemed almost impossible to get superintendents of manufacture to write about the problems with which they are wrestling. Various reasons for this are obvious on the surface.

Superintendents of manufacture, it might well be said, "have their noses to the grindstone" to a greater extent perhaps than workers engaged in any other branch of the industry. Appliances are sold on but six days of the week at the most, but gas has to be made, generally speaking, on seven. By the very conditions of their work superintendents of manufacture are tied down to it in a way that precludes any opportunity of their finding time for personal purposes much beyond the barest of needs in the way of recreation.

Writing an article for a technical journal represents, therefore, to the superintendent of manufacture a considerably greater proportion of effort than it does to the commercial man, for instance.

Further, the superintendent of manufacture is essentially a technical man, with all of the technical man's aversion to being exploited. Manufacturers of gas-making apparatus have a natural pride in their product. Let the superintendent describe some especially good results he has obtained through some unique methods, and it is not only likely, but altogether natural, that the manufacturer of the equipment by which the results were obtained would lose little time in giving full publicity to them, in nine cases out of ten stressing the part the apparatus played rather than the man.

Then, there is the attitude of managements to be considered. We have not yet entirely gotten away from the element of secrecy in regard to operations inside our plants. There are few plants in the country where an interested and responsible person would be refused access to. Yet, when it comes to spreading out the details before the eyes of an expert audience more than one management will balk. They believe sincerely that they have attained the maximum efficiency; that there are no loose cogs; but they are not so sure of it that when it comes to a show-down they are willing to place all their cards face up on the table.

We have appreciated all these conditions, and have found them in many cases seemingly insurmountable.

Nevertheless we have persisted, for we have realized that there is a need for this class of information and a demand for it in the field.

As a result we are able to publish in this issue an article on water gas manufacture economies that we are certain will be carefully read by those interested in this branch of manufacture. We are equally certain that those who read will profit thereby.

The author is not a theorist. He has had an extensive experience in this line of work in the plants of foremost gas companies. Furthermore, he is not a mechanical worker. A job to him has not been merely a job. It has been an opportunity of just as much value as he could, himself, find in it. He has learned as he has practised. The results of his years of study and of thinking are condensed in the relatively few pages that go to make up this article.

Real Service

The most recent effort of the National Commercial Gas Association to create good-will on the part of gas consumers is worthy of the whole-hearted cooperation of all companies. The AMERICAN GAS ENGINEERING JOURNAL has never been satisfied that the industry has been doing as much for the consumer as it should. By this let it not be inferred that we think it has not been spending enough money in their behalf. Perhaps it has been spending too much, but that the maximum of good has not been attained per dollar spent.

This new effort is designed to instruct in the cooking of certain classes of foodstuffs in such manner as to return economies to the consumer. This is a subject that any housekeeper at the present time will lend a willing mind to.

We can perceive how this effort may have far-reaching results. If a greater proportion of consumers knew how to get the most efficient returns from the gas-burning appliances they use, there would be considerably less gas used per family per appliance in use. Consequently there would be lower gas bills and less agitation for lower rates from time to time. This could be accomplished by educational work. But, because it is educational work of a more or less technical nature, the mind must be prepared to absorb it, if the effort is to be made in the most economical manner: namely, by circularization. The consumer must be educated into the habit of reading the instructive matter the company sends her. Efforts similar to the "Thrift" folder series of the National Commercial Gas Association might well be made the means of forming such habits among our consumers.

Selling Appliances in Economy Times

It must be somewhat illuminating to those who but a few months ago were worrying about the degree of curtailment they should make in their sales efforts to read the frequent reports we are receiving of appliance sales going far beyond any previous records. The lesson contained in these returns is that economy times are the logical time for gas-appliance sales.

These are economy times; not to the degree as yet that the Government would desire them to be, but to a very considerable degree nevertheless. People who have always intended to save but never did save now find themselves compelled to save, due to their patriotic ardor in subscribing to Liberty Bonds. Out of the more than ten million subscribers throughout the country there are doubtless very many who find they have stretched themselves beyond the point of comfort.

They are better off in consequence. Eventually they will have a bulwark between themselves and adversity, and they will know that they did not miss much in the luxuries and illusionary conveniences they were compelled to sacrifice to obtain it. In the meantime, however, they must adjust their expenditures here and there to meet the pinch.

The great saving will be made in the way of domestic service. Raising wages is compelling extensive readjustments in this respect already. The woman who could afford the luxury of a servant at twenty dollars a month finds it an unattainable luxury at forty. The great bulk of housekeepers, however, will hold off until the last ditch.

Their ideas of doing their own work are based on the old idea of abhorrently early rising to build a fire in the stove, of vexatious waiting and effort to obtain a sufficient heat, of hours of tedious effort and damaged hands due to dish washing, etc. It is extremely doubtful if the great mass of housekeepers are even dimly cognizant of the labor-saving possibilities of gas-using appliances.

Merely calling them to their attention will be enough to influence a vast number who have about reached the breaking point on the servant question. These women, even under present high prices, can afford to pay twenty dollars a month for a servant, but forty is almost the breaking point. Show them that gas will reduce the home labor to the point where the wear on the endurance is less than the mental wear and tear of trying to make ends meet while retaining a servant that costs more than the family can afford, and it is quite likely that a prospect can be turned into a customer without much further canvassing.

It might be profitable to get down to facts in regard to saturated districts. Let us avoid theories in

this regard. We have been accustomed to assume, say, that because there is one gas range to every five inhabitants in a district that it has reached the saturation point. A house-to-house canvass will determine whether it has or not, and such canvasses pay.

There is sufficient new business along the mains of most companies to justify all the efforts of a pretty complete sales department. The amount we can put on our lines, with benefit to all concerned, if properly gone after, will, in the opinion of the AMERICAN GAS ENGINEERING JOURNAL, be limited only by the number of appliances we can get the manufacturer to produce for us.

Utility Does Not Receive a Fair Valuation When Cost of Physical Property Alone is Considered

Superior Court of Pennsylvania Lays Down This Opinion in Reversing Orders of Public Service Commission — Depreciation, if Replacements and Renewals are Provided For, Takes Place to But a Very Small Extent

In reversing the order of the Public Service Commission on rates and valuation in the case of the Ben Avon Borough vs. the Ohio Valley Water Company, the Superior Court of Pennsylvania lays down the following in its opinion:

FAIR DEALING CONTEMPLATED

"In determining the questions of rate-making value and rates, the commission is given extensive powers to be exercised after a thorough consideration of the business from the most accurate knowledge obtainable. The questions present matters of such grave importance as to call for the most careful consideration by the commission designated by the Legislature to act. A rate that is too low may deprive the members of the corporation of property that cannot be returned, and if too high the public is unjustly deprived of property. Rates should not be speculative or put in operation for the purpose of determining whether too low or too high. Before that question can be answered a loss of property might result. The business of rate making should not be an effort to impose on either the public or the corporation; and while it may be true that some corporations in the past have acted unfairly to the public, that would not justify a confiscatory valuation by the commission or a lowering of rates causing a confiscation. Rate making contemplates fair dealing between the company and the public. When the question of rates to be fixed is before the commission, the value of the whole property and the net return thereon must be considered.

"The public is entitled to be served at reasonable rates on the value of the property used in the public service. The company is entitled to a rate that will allow it a fair return. To induce investment and the continuance of capital there must be some gain commensurate with that of any other business. The mere assurance that the investment will not be confiscated will not suffice.

INCREASE IN VALUE OF PROPERTY ENTITLED TO RETURN

"The value of the property is to be determined as of the time when the inquiry is made regarding the rates. If the property which legally enters into the question of the consideration of rates has increased in value since it was acquired, the company is entitled to the benefit of such increase.

"Original cost, assuming that the books of old concerns correctly recorded all of the items that went into cost, which would be quite rare, would not take into consideration many of the incidental features of expense which companies must meet, nor would it make any allowance for any 'increase in value' in the physical property.

"The present value represents more than the cost of reproduction, which is the present-day cost of the real estate, machinery, equipment or plant, labor of installing or construction, and putting in place to perform its various functions. These constitute, as Justice Lurton says, in Omaha vs. Omaha Water Company, 218 U. S. 180-202, 'the bare bones of the plant, its physical properties.' The expenditures beyond physical cost are sometimes called overhead charges, and some of the items are termed preliminary, developmental or going concern costs, or value. To these bare bone charges must be added 'time and money expended in the promotion of the enterprise; in the organization of the company and interesting capital therein, including, also, legal expenses, obtaining the necessary franchise, as well as the costs of incorporating the company'; engineering and superintendency; losses arising from accidents to men and material during the construction period; expenditures bound to be made by reason of the incompleteness of plans, always attached to the most perfectly planned work; the cost of administration; interest paid during construction; securing and retaining customers; the loss of earnings during the time usually required in a well-managed, progressive plant to build up its business; the loss from unsuccessful experiments intended to protect life and property, or reduce operating cost, or increase the efficiency of the service; the installation of machinery made necessary through the progress of scientific development, thereby causing good but inferior machinery to become obsolete; increased public demand, causing the present equipment to become inadequate through lack of capacity and its replacement necessary; the cost usually attendant upon the consolidation of many plants into one efficient organization, the benefit of which should be reduced cost of operation and better service; and the increased value of such consolidated plants over the separate units that formerly composed them.

RULING ON DEPRECIATION

"A company does not receive a fair valuation when the cost of its physical property alone is considered. Nor do we wish to be understood as saying that the exchange value used in condemnation and sale should be the basis upon which the rate should be determined. In this latter value the income is assured and its continuance enters into and affects it. In exchange or selling value, the ability of the utility to

produce earnings is a large factor, if not the controlling factor; but such value of necessity takes into consideration the monopolistic feature of a utility. It produces earnings by virtue of the commodity it sells; its position in public life to command sale from the compulsory aspect which causes the inhabitant to buy, whether he will or not. These companies secure an added value from these causes.

"Depreciation, though largely theoretical in its nature, which is allowed on the reproduction cost seems to have a fixed place in valuation. If, however, replacements and renewals are amply provided for and made, depreciation only to a very small extent takes place. If, through depreciation, the value of the property is largely reduced, the securities which were placed thereon may be unnecessarily reduced in value. As these charges withdraw from the rate-making base, such depreciation naturally effects a purchase of a part of the property for the consumer, a thing never contemplated. A rate for renewals and replacements should be provided and expended for that purpose; when that is done, as is the custom in every utility concern, depreciation is a very small fractional per cent. This should be placed in a reserve and it, with renewals and replacements, is properly allowable in fixing a schedule of rates."

How the Gas Companies are Helping the Nation

THE GLOUCESTER GAS LIGHT COMPANY, Gloucester, Mass., has a large service flag with five stars in the field hung outside its office. It is in honor of five employees who have entered the service during the war. The young men are:

Ralph Karcher.....Army
Alfred Jedrey.....Navy
Edward Brown.....Eighth Regiment Band
Edward L. Strople..Army
William Peach.....Army

LIEUT. H. C. MORIARITY, who entered the employ of the Northern Indiana Gas & Electric Company in February, 1910, as new building and factory representative, is now at Camp Mills, Garden City, Long Island, with the "Rainbow Division," Battery B, 150th F. A. (First Indiana), 67th Brigade, which is slated for early service overseas. This is the third time he has entered the call of his country's flag.

He entered the military service in the war with Spain, as a private in the 28th Indiana Volunteer Battery, and served from the call to arms, April 26, until the muster out of his battery in November of that year.

Upon reorganization of the Guard of Indiana in 1900 he entered the service again as a member of the Artillery Unit at Fort Wayne, serving as corporal and sergeant until April, 1905, when he was commissioned senior first lieutenant, a commission which he held until 1913, when, at his request, he was placed on the retired list.

Upon the outbreak of the trouble with Mexico, last year, Fort Wayne was asked to recruit a battery for border duty, to replace the unit from Purdue University, then on the border. Lieut Moriarity assisted in the work of recruiting Battery D at Fort Wayne, and served on the border at Llano Grande, Texas, as first lieutenant, from Aug. 25, 1916, until March 8, 1917, when his battery was mustered out of the Federal service.

At the declaration of war with Germany it was decided to increase Indiana's artillery battalion to a full regiment. Lieut. Moriarity was transferred to Fort Wayne's new unit and went in training at Fort Benjamin Harrison. Since reaching Long Island his battery has been changed from 3-in. field artillery to 6-in. howitzer.

Lieut Moriarity served two terms as commander of Zollinger Camp No. 36, United Spanish War Veterans, and also served on the staff of the department commander of that order.

SAMUEL INSULL, chairman of the board of directors of the Peoples company, is also chairman of the Illinois State Council of Defense. He may be found practically every day at the headquarters of the council in Chicago, a tireless worker for the State and nation as well as for his company.

THE EAST OHIO GAS COMPANY subscribed $1,000,000 to the second Liberty Loan. Cleveland was allotted $650,000; Akron and Youngstown, $50,000 each; Canton, $25,000; and smaller cities, including Uhricksville, Dennison, Kent, Ravena, Warren, Wooster and Barberton, the remainder. The management of the company got into phone communication with its local managers in the various places and distributed the subscriptions with a view to helping each local committee reach its quota. This company recently published in the Nov. 1 issue of *The East Ohio News* the following roll of honor of the employees in the national service:

Anderson, S. E., Operating Department, Cleveland, 305th Ammunition Train, Camp Lee, Virginia.

Benton, Phil, Office Department, Cleveland, Officers' Reserve Training Camp, Plattsburgh, N. Y.

Bluem, C. F., Chemist, Cleveland, First Sergeant, Battery A, O. N. G. 1st Field Artillery, Montgomery, Ala.

Bridgen, F. E., Engineering Department, Cleveland, Second Lieutenant, Company D, 6th Reg't, U. S. Engineer. Somewhere in France.

Burton, P. H., Operating Department, Cleveland, Battery A, 1st Ohio Field Artillery, Montgomery, Ala.

Cole, S. J., Engineering Department, Cleveland, Second Lieutenant, Machine Gun Battalion, Gettysburg, Pa.

Donahue, William, Office Department, Youngstown, Medical Department, Camp Wadsworth, Spartansburg, South Carolina.

Dunbar, William, Operating Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Eldred, P. H., Operating Department, Cleveland, Company E, 112th U. S. Engineers, Camp Sheridan, Montgomery, Ala.

Farnsworth, Madison, Office Department, Canton, Sergeant Major, 61st Aero Squad, Camp Kelly, South Antonio, Texas.

Fisher, R. E., Office Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Fitzmaurice, F., Operating Department, Canton,

Camp Sherman, Chillicothe, Ohio.

Foster, Grover C., Operating Department, Cleveland. Enlisted.

Gable, N. L., Office Department, Akron, Sergeant Truck Company 121, Quartermaster Engineers' Relief Corps, Fort Benjamin Harrison, Indianapolis, Ind.

Giblin, J. F., Operating Department, Cleveland, National Naval Volunteers, Landman for Shipwright.

Giblin, J. J., Operating Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Graham, J. F., Office Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Gregory, J. W., Office Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Grimes, Thomas, Trunk Lines Division, Company C, 1st Federal Branch, Signal Corps, Camp Alfred Vail, Little Silver, Monmouth Park, N. J.

Guscott, E. G., Office Department, Cleveland, Sergeant Company D, Ohio Engineers, Chillicothe, Ohio.

Henry, John, Operating Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Hissom, L. K., Trunk Lines Division, Camp Sherman, Chillicothe, Ohio.

Hogan, A., Operating Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Hogan, Joseph J., Office Department, Cleveland, Sergeant Company B, 112th Reg't U. S. Engineers, Montgomery, Ala.

Lenorcic, Joseph, Operating Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Locker, Walter A., Purchasing Department, Cleveland, Corporal Company B, Engineers, 112th Reg't, Montgomery, Ala.

McBride, W. J., Office Department, Youngstown, 25th Field Hospital, Camp Gordon, Atlanta, Ga.

Madison, Harold, Operating Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Meyer, A., Operating Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Miller, A. E., Office Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

McDonnell, M. J., Office Department, Cleveland. Government appointment.

Maltby, E. A., Operating Department, Cleveland, Aviation Corps, Buffalo, N. Y.

Mann, J. H., Office Department, Canton, 7th Infantry, Fort Benjamin Harrison, Indianapolis, Ind.

Mulligan, Joseph, Operating Department, Cleveland, Supply Company, 331st Infantry, Camp Sherman, Chillicothe, Ohio.

Oliver, H. T., Operating Department, Cleveland, Signal Corp, 6th Engineers' Train, Washington, D. C.

Omlor, Andrew H., Office Department, Youngstown, 25th Field Hospital, Camp Gordon, Atlanta, Ga.

Parkison, T. C., Office Department, Cleveland, 2nd Field Artillery Band, 135th Reg't, U. S. Field Artillery, Montgomery, Ala.

Phelan, H. V., Operating Department, Cleveland. Camp Sherman, Chillicothe, Ohio.

Randolph, V. M., Operating Department, Cleveland, Battery B, First Ohio Field Artillery.

Reitz, J. C., Engineering Department, Cleveland. Capt. Company D, 6th Reg't, U. S. Engineers.

Rogers, W. G., Engineering Department, Cleveland, Company D, 6th Reg't, U. S. Engineers. Somewhere in France.

Schumacher, H., Operating Department, Akron, Truck Company No. 1, Motor Section, 112th Ammunition Train, 37th Division, Montgomery, Ala.

Taylor, William A., Office Department, Cleveland, Junior Lieutenant Navy, Attached to Cruiser Charleston at New York.

Tobey, C. W., Office Department, Cleveland, Corporal Company B, 112th Reg't, U. S. Engineers, Montgomery, Ala.

Towson, Carl W., Office Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Van Loozen, A. J., Office Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Venus, R. E., Office Department, Cleveland, Second Lieutenant U. S. Infantry.

Wagner, E. W., Operating Department, Cleveland, First Lieutenant, Battery A, 1st Battalion, Ohio Field Artillery.

Walters, Amos, Trunk Lines Division, Camp Sherman, Chillicothe, Ohio.

White, J. L., Operating Department, Cleveland, Camp Sherman, Chillicothe, Ohio.

Wilbrink, Charles, Operating Department, Cleveland, Corporal Company A, 1st Ohio Engineers, Camp Perry, Ohio.

Wilbrink, E. R., Operating Department, Cleveland, First Regiment Ohio Engineers, 305th Engineers' Train, Camp Lee, Petersburg, Va.

THE EMPIRE GAS & ELECTRIC COMPANY, of Auburn, N. Y., held the first meeting of the season, with about forty employees in attendance, at which A. D. Smith and L. C. Reynolds both gave addresses regarding the Liberty Loan, urging the employees to buy bonds and pointing out the easy instalment plan of the company. The employees have purchased about $3,000 worth of the second loan and in the first loan they took nearly $4,000 of bonds. The employees recently subscribed to a tobacco fund for their fellow employees who are in the service, a fine sum being realized. There are ten employees of the company now serving Uncle Sam, and their fellow employees back home will see that they do not lack for tobacco.

THE PEOPLES GAS LIGHT & COKE COMPANY, of Chicago, women employees are now perfecting the organization of a regular unit of the Chicago Chapter, American Red Cross. The unit will meet immediately after business hours and the members will make bandages, hospital gowns and other standard Red Cross supplies.

THE WISCONSIN PUBLIC SERVICE COMPANY, Green Bay, Wis., employees subscribed $4,000 to the first Liberty Loan and the company subscribed $30,000 to the second loan. It is selling to employees whatever amounts they might care to subscribe to on easy payments. Its employees also contributed largely to the Red Cross. Though the company has several men subject to draft, none have been called as yet, as Green Bay made up its quota by volunteering.

Merchandising Gas

Lack of Self Confidence the Greatest Hindrance to Success

Prof. Ralph Wilson Cites Various Significant Examples for Benefit of New England Commercial Men

The speaker of the evening at the meeting of the New England Section of the National Commercial Gas Association, held at the Boston City Club, Oct. 26, was Prof. Ralph Wilson, of Boston University. His topic was, "How to Succeed in Business." He said in part:

"Most people measure success from a monetary standpoint in dollars and cents. We say if a man has money he is successful; if he hasn't money he is a failure.

"This, however, is not a definition of success.

"One may never acquire money or wealth and yet be successful."

Using himself for example, he said:

"I was a boy in a coal mine in Ohio and worked weeks at a time without seeing daylight except Sunday afternoon. I never attended a high school in my life, and worked my way through college. I had chosen a life's work and wanted to do it."

The Earmarks of Efficiency

Professor Wilson was not egotistic in his remarks, but simply used them for an illustration to prove that any person could attain a degree of success if he put his mind to work to solve problems. His friends told him that he would be thirty-eight years old before he got through school. His answer was that he would be thirty-eight years old anyway, and that he might as well be in school as in a dead-end position.

Professor Wilson told of many successful men in business as employees and employers. One in particular, M. S. Connors, president of one of the big Western railroads, who in thirty years had never made a mistake in picking successful men by their traits.

ATTRACTIVE WAFFLE IRON DISPLAY DURING RED CROSS DEMONSTRATION AT ELKHART, IND.

At one time Mr. Connors was asked how he picked his men for responsible positions. His answer was that he looked at the eyes to see the amount of white in them, at the mouth to see if the lips were firm, at the face to see whether it was open or otherwise. He said that a man's ability would be written on his hands, his face, his teeth and general appearance.

Self-Confidence

Professor Wilson told of a man he knew who had been at one desk since 1872, starting with a salary of $50 per month and now receiving $75 per month; just a bare living.

This fellow, from a moral and physical standpoint, was above the average, but he lacked confidence in himself.

He said the greatest hindrance men have is lack of self-confidence.

Using an example, he said:

"If I were to divide this body of men in halves for a debate on the subject 'Government Ownership of Railroads,' and then dismiss them to prepare their arguments, the first

(*Continued on page* 458)

Waffle Sale for Red Cross Benefit a Huge Success

Elkhart Gas & Fuel Company Increase Sales, Popularize Gas Show Rooms and Help in National Cause

The Elkhart Gas & Fuel Company, of Elkhart, Indiana, had a most successful waffle demonstration in their salesroom on Saturday, Nov. 3. The Domestic Science Class of the Elkhart High School, consisting of forty girls and three teachers, prepared and baked the waffles.

The salesroom was cleared of ranges and gas appliances, and tables and chairs were arranged to serve about fifty people at a time. Six one-burner hot plates were installed in one of the large show windows, and the waffles were cooked in view of all. The girls who did the cooking and serving were dressed in white and wore the Red Cross insignia. With the waffles were served maple syrup, butter and hot coffee. The small sum of 10 cents was charged each person, and the entire proceeds donated to the Red Cross. The gas company furnished all the materials gratis, consisting of five sacks of

CLOSE-UP VIEW OF THE GIRLS WHO DID THE BAKING AT ELKHART

flour, 6 lb. of baking powder, 18 doz. eggs, 21 lb. of butter, 12 lb. of lard, 20 gal. of milk, two sacks of salt, 15 lb. of sugar, 11 lb. of coffee and 9 gal. of maple syrup. Local firms donated a portion of the materials.

The demonstration had the personal supervision of John A. Patten, general manager, and J. Weaver Smith, commercial agent. It was a success in every sense of the word, resulting in an increased sale of waffle irons and popularizing the gas company with the people of Elkhart. The gas office was crowded with people from 9 a. m. to 9 p. m., and over 1,000 people were served.

Figure No. 1 gives a close-up view of the girls as they were baking the waffles. Figure No. 2 shows a view of the salesroom with the people being served. Figure No. 3 shows the other show window neatly trimmed with waffle irons and appropriate show cards, as well as the front of the company's building.

The event was advertised extensively in the newspapers and moving picture shows for a week previous. The Boy Scouts helped out by carrying "sandwich" signs up and down the main retail street and also through the large stores. These signs read:

Do Your Bit.
HELP RED CROSS FUND.
Attend the Waffle Sale at the
GAS OFFICE
TO-DAY

A boy dressed in a chef's white coat and cap stood on the sidewalk in front of the gas office and rang a dinner bell during the demonstration.

The local chapter of the Red Cross were so enthusiastic over the demonstration that they have requested a repetition of the performance. All those participating in the demonstration have been the recipients of many compliments on the manner in which it was conducted.

Lack of Self-Confidence the Greatest Hindrance to Success

(Continued from page 457.)

question to be asked would be, 'Where can I find something written on the subject?'

"People do not use their own minds, but depend upon someone else to think for them. Would it not be pleasing to think and work out problems in one's own mind and then read up works on the subject and learn that others had written just as you had thought?

"We call men who have achieved success geniuses.

"What is a genius? Just a human being that has used his brains and thought.

"We say that such men as Watt, Edison, Bell and others were born great.

"Thomas Edison, when a boy in a little country school, was not considered able to learn. The teacher sent for his mother and told her that she would have to take Tom out of school, as he was not quite right and could not learn. He never attended school after that.

Mind a Blank on Witness Stand

"He was a newsboy on the trains when he became interested in chemicals, and one day nearly blew up the train. Sometime after he became a telegraph operator, but he did not give up his study of chemistry. However, to this day Edison cannot take a witness stand as a witness. His mind becomes a blank.

"On one occasion when one of his experiments was a failure he turned to his secretary and asked, 'How much did this cost?' The answer was $1,000,000. Edison simply said, 'Well, we had a wonderfully good time.' He does not think of money, eat or sleep when work is to be done.

"How many employees we see watching the clock for 5 p. m. to get through, not watching it to see how much after 5 it is and how much longer they can work before they have to quit to eat and sleep.

"Would we be any more productive on a larger income If we were more productive we would have larger incomes.

"In the report of the Federal Commissioners of Labor it is stated that labor is not as productive as in the past because it is overpaid.

"He who does not do any more than that for which he is paid is not paid for any more than he does.

"Alexander Graham Bell was a professor of phonetics at Harvard, and wanted to make a deaf and dumb person hear when he began his experiments. He was not thinking of the telephone. He evidently succeeded for the deaf and dumb person has been his wife ever since.

"Bell went to a doctor and asked him about the ear. The doctor suggested that he get a human ear and take it apart, but as people are not always willing to have their ears taken apart he was at a loss as to what to do. However, this doctor in some way found an ear for Bell, and he took it apart and learned the action of the eardrum and the part it performed in hearing. Four years later he said, 'Come here, Watson,' from the next room, and a few years ago said the same words to Watson from Boston to California.

The Genius Defined

"These geniuses are just as human as you or I, and to the person that will use his brain and learn to think there are just as many opportunities as ever.

"A genius is a person that can do three times as much work as is required of him.

"We cannot attain success in a night.

"The piano pupil does not begin to play difficult pieces at once, but gradually works up to the point where he is a master of the art.

"Why do we go to school? To be successful? No. Why do we study the various arts, and how much of them do we remember? Very little after we leave school.

"All of our schooling is for one purpose only—to teach us to think and think and think.

"A few years ago a young telegraph operator on a Western railroad was interpreting a certain rule. It is very easy sometimes to misinterpret a rule, but this fellow would not be convinced that he was wrong, and stated that if the president of the road and all of the superintendents told him different he would still believe his way. To-day he walks the streets.

"He had closed his mind to conviction. A closed mind is a sure failure.

Give Up the Job That Is Not Agreeable

"We must be broad-minded, thinking, acting, working people, willing to admit when we are wrong and fight to the last drop of our blood when we know we are right.

"Do with a will that to which you are giving your life.

"If you do not like your job give it up and do the thing you want to do.

"If you don't believe in the gas business, if you do not care to study it, give it up and give the other fellow a chance. What you do, do well.

"There are many positions open for $5,000 a year and a few for $2 a day.

"When a position was opened for an extra clerk in a store at $10 there were 165 applicants; for a position as credit man at $125 per month only four, and for a $5,000 a year position not one.

"We classify ourselves. We know we are not capable of the big things in life."

GAS COMPANY DISPLAY ROOM WAS PARTLY CLEARED FOR WAFFLE DEMONSTRATION

Professor Wilson's speech was enjoyed by all present. Although the hour was growing late he was continually urged to go on with his talk.

The meeting adjourned at 10.30 p. m., and was pronounced one of the most interesting meetings held by the association. This journal is indebted to C. D. Bond for the foregoing information.

Denver's October New Business Breaks All Previous Records

All previous records for new business sales were broken in Denver last month. Complete figures as to the total business done in October are not yet available, but it is evident that the amount will be more than $40,000. In commenting upon the figures, Clare N. Stannard, new business manager of the Denver Gas & Electric Light Company, said to Denver's salesmen:

"The showing made during the past month shows the wisdom of the splendid suggestions made by George Williams at the beginning of the war, not to discontinue new business departments, but to put them on a new basis and ultimately they would become self-sustaining and an asset to the companies instead of a liability. Our sales for the year will run to $300,000, as against only $50,000 a few years ago. In other words, you gentlemen have been graduated from the class of peanut merchants into real salesmen, and in order for those of us watching stock to keep up with you it has been necessary for us to get out of the peanut purchasing class, and where we used to place orders for $500 or $1,000 worth of goods, we now place orders for $30,000 worth."

Scarcity of Servants Increases Sales of Domestic Appliances

Sales by the new business departments at the Doherty properties are one-half again as much as in 1916, according to a statement recently made by George Williams, manager of the new business department of the organization.

In commenting upon the increased sales, Mr. Williams pointed out that the war was chiefly responsible for the greatly increased demand for electric and gas appliances. He said that the war in causing a scarcity of labor in all branches of work, had not overlooked domestic workers, with the result that servant girls were scarce. This scarcity of servants has made the housewives of the country do their own work, and they have tried to simplify that work as much as possible. For that reason the labor-saving gas and electric appliances have been in great demand with the consequent benefit to new business sales.

Another N. C. G. A. Plan to Help Increase Sales and Create Goodwill Among Consumers

Two questions are going to occupy the biggest part of the woman's attention this winter.

FOOD AND FUEL

In this fact lies the value of the six "Thrift" folders—regular envelope size—on food as cooked by gas, which the National Commercial Gas Association will supply for distribution by gas companies to domestic gas consumers.

These new folders are to take up the good work for the period between canning seasons. They will have less to say of patriotism and more about the use of gas. Their appeal to the housewife will be their simple and very practical treatment of a subject that is so vital to American households at this time—food economy in buying, preparation and serving.

THE FOLDERS WILL BE PREPARED WITH THE IDEA OF INCREASING GAS CONSUMPTION BY:

1. More baking.
2. Home rendering of fats.
3. Grilling of vegetables to offset deep frying (now tabooed by fat shortage).
4. Fish broiling (to reduce meat consumption).
5. More steamed breads (to conserve wheat).
6. Long continued cooking of cheaper cuts of meat, and the legumes as meat substiutes.

THE ARGUMENTS TO THE CONSUMER FOR ECONOMY WILL COVER:

1. Time saving.
2. Food saving by proper cooking.
3. Energy saving by simple wholesome dishes.
4. Money saving by careful planning, intelligent marketing, proper care of food, cooking to the best advantage, etc.
5. Co-operation with the Government in conserving meat, wheat and fat.

THE SUBJECTS FOR THE FOLDERS WILL BE:

1. Bread baking—the home-made loaf, simple batters, comparative costs and values.
2. Fish—from market to mealtime.
3. Useful utensils—material, construction, size, shape, and purpose in gas cookery.
4. Meat, and how to make the most of it.
5. The use of household fats: "to make one wise dollar do the work of two foolish ones."
6. Vegetable economy and help for hot weather.

A generous distribution of such literature by the gas companies will give valuable publicity, create a spirit of good will, and increase sales of gas at maximum rates to a class of consumers where no additional investment is necessary by the gas company.

Before the association proceeds with the printing, it is necessary to know how many folders each company will require, and also whether one color without a cover design or with an illustrated colored cover is preferable. Prompt action in placing the orders will be appreciated.

PRICE OF FOLDERS—F.O.B. NEW YORK

Printed in one color, without illustrated cover, $2.25 per 1000.

Printed in one color, with illustrated colored cover, $4.50 per 1000.

Massachusetts Commissioners Lay Down Model Ruling

Find that It is Not in Public Interest to Attempt to Determine in Any Final Way a Fair and Reasonable Price of Gas

In ruling on a petition of the Newburyport Gas & Eectric Company for approval in raising its rates beyond a point hitherto authorized by the board, the Board of Gas and Electric Light Commissioners of Massachusetts states as follows:

This company supplies both gas and electricity. It is charging for gas $1.25 net a thousand cubic feet. On Nov. 22, 1910, upon complaint under the statute by the mayor of Newburyport, the board found that the price of gas might reasonably be reduced from $1.40 to $1.35 net, and its recommendation to that effect was accepted by the company without the necessity for an order. On Aug. 1, 1913, the price was reduced voluntarily by the company from $1.35 to $1.25 net. The purpose of the present petition is for authority to increase the price beyond the limit fixed by the board in 1910 to $1.50, in order primarily to meet war conditions.

The board has not felt that it is in the public interest to attempt to determine in any final way the fair and reasonable price of gas in Newburyport or elsewhere at a time when the cost of every item entering into the construction, operation and financing of gas plants has reached exceptional and unprecedented levels. It may be confidently hoped that this abnormal situation will not outlast the war. When normal conditions are restored it will then be possible to reach just conclusions, resting on reasonable and stable grounds. Meantime some relief should be granted, although both consumer and stockholder must realize that in a time of great stress and in meeting conditions for which neither are responsible there must be sacrifice and self-denial on both sides. In the opinion of the board the price hereinafter named will give the company a reasonable measure of relief, which in conjunction with all the business of the company will tide it over the present emergency. Should experience demonstrate that a higher or a lower price is called for to discharge the natural obligations of the consumers, a modification of this order will be made.

In view of the foregoing considerations, the following order has been adopted:

On the petition of the Newburyport Gas & Electric Company, under the provisions of section 163 of chapter 742 of the Acts of the year 1914, for a revision of the former action of the board, whereby on Nov. 22, 1910, the price of gas thereafter sold and delivered by said company was fixed at not exceeding $1.35 net a thousand cubic feet, and for authority to increase its price to $1.50, after notice by publication and by personal service upon the Mayor of Newburyport and a public hearing, it is—

Ordered, That the former action of the board on Nov. 22, 1910, fixing the price of gas thereafter sold and delivered by said company at not exceeding $1.35 a thousand cubic feet, is hereby revised, and said company authorized to charge for gas sold and delivered after Oct. 1, 1917, not exceeding $1.40 net a thousand cubic feet for the duration of the war, unless meantime otherwise ordered upon complaint or petition, as provided by law, or upon the board's own motion after notice and a public hearing.

The AMERICAN GAS ENGINEERING JOURNAL is indebted to Albert M. Barnes, general manager of the Cambridge Gas Light Company, for the information in regard to the foregoing order.

News of the Gas Industry

Philadelphia Effects $51-260.40 Saving by Converting Gasoline Lamps to Gas

By converting 8,057 gasoline into gas lamps during this year, Philadelphia, Pa., has effected a saving in lighting expense of $51,260.40, according to a report made public by Director of Public Works Datesman. The lamps have been changed gradually since Jan. 1.

During the latter months of 1916, 3,147 lamps were converted similarly, and the cost of maintaining them this year was reduced $41,068.65. The 1917 contract prices are at the annual charge of $36 per lamp for gasoline, and $25.75 for gas.

Next year there will be virtually no gasoline lamps in the city.

Saint Louis Acts Immediately —Grants Standard Reduction to Allow Toluol Extraction

Officials of the Laclede Gas Light Company and city officials have reached an agreement whereby the gas company will be permitted to reduce the strength of its gas from 600 to 575 B.t.u., so the company may supply more toluol for the use of the Government in making high explosives.

The reduction will not affect the lighting or heating qualities of the gas and consequently there will be no reduction of charge to the consumer, officials of the gas company said after the conference.

Director of Public Utilities Hooke and George Evans, chief engineer of the gas company, will go to Jefferson City to ask permission of the State Public Utilities Commission to make the change. City Counsellor Daues has started drafting an order that it will be necessary for the public utilities body to sanction before the gas company can reduce the strength of its product.

The agreement will be for as long as the Government buys toluol from the Laclede company for war use. The company has agreed to spend $300,000 to $350,000 equipping its "A" and "B" plants to make toluol. C. L. Holman, president of the company, has promised that as soon as the proper legal steps are completed he will order the equipment.

Holman, Davis, Hooke and Daues recently went to Washington to confer with the ordnance department of the War Department on just what was expected from both sides in aiding the Government at this time.

Tacoma, Wash., Company Asks 5-cent Increase

The Tacoma Gas Company, through its receiver, Elmer Dover, has filed with the State public service commission a new tariff of rates. The commission is asked to sanction the new rates, which the company desires to put into effect Dec. 1.

The Tacoma company is asking that it be allowed to charge 5 cents a thousand feet additional for gas after Dec. 1, and other modifications in the present schedules are requested. The present rate is $1.25 a thousand for the first 5,000 ft. The company says that the cost of making gas and delivering it to customers has greatly increased in the past year, and it is declared that the raise in rates will not entirely cover the added cost of doing business.

Many Uses of Gas in Making Shells

FUSE CAP
FUSE PLUG, SOCKET AND BURST
"BOSING-IN" TOP OF SHELL BODY
LACQUERING INSIDE OF SHELL TO PREVENT CHEMICAL ACTION BY ACIDS IN EXPLOSIVES
BULLETS IN SHRAPNEL SHELL
RESIN TO KEEP BULLETS IN PLACE
COPPER BAND SHRUNK ON TO SHELL BODY
SOLID BILLETS USED FOR MAKING SHELLS
THE SHELL BODY
BRASS SHELL-CASE
IN BORING, TURNING AND SHAPING SHELL-BODIES
Section of Shrapnel Shell
Section of High-Explosive Shell

SELF-EXPLANATORY DIAGRAM OF THE PART GAS PLAYS IN SHELL-MAKING, AS REPRODUCED FROM "ADVANCE CLUB NEWS"

Western Gas Construction Company Reorganized with Additional Capital

The Western Gas Construction Company has been reorganized and additional capital secured which will place the company in a strong position, enabling it to give prompt attention to orders for standard apparatus and equipment as manufactured in the past, and as well as to accept orders for new work.

The plant includes the pattern shop, machine shop, foundry, forge and tank shops located at Fort Wayne, Ind.

O. B. Young has been made manager and William C. Marquardt assistant treasurer. O. N. Guildin, on account of ill-health, will retire from the active management of the business, but will be retained in a consulting capacity. Thos. W. Stone will continue with the company as chief engineer.

The reorganization of the company was announced at the completion of a business transaction which had been "hanging fire" for several months.

It is predicted that the company, under the new organization, will rapidly extend its operations necessitating the employment of many additional employees.

Commission Grants Increase That Aldermen Deny at Elizabeth City, N. C.

The Corporation Commission of North Carolina has granted the Gas Company of Elizabeth City an increase of approximately 25 per cent over its former rates, although the aldermen had refused the increase. Here is what Elizabeth City will have to pay for gas under the new schedule:

First	1,000 cu.ft.	$2.00 per M.
Next.	4,000 cu.ft.	1.80 per M.
Next	5,000 cu.ft.	1.60 per M.
Next	5,000 cu.ft.	1.40 per M.
Next	10,000 cu.ft.	1.20 per M.
Over	25,000 cu.ft.	1.10 per M.

There is a discount of 10 cents per 1,000 ft. on the above figures, making the minimum new rate $1 per 1,000 and the maximum for small consumers $1.90 per 1,000.

West Virginia Company Granted Permission to Increase Rates to Industrial Consumers

The public service commission recently allowed the application of the West Virginia Traction & Electric Company, of Wheeling, for permission to increase rates to industrial consumers of gas as supplied by it in Wheeling and its suburbs. The new rates, effective from Oct. 1, are as follows: First million feet, 20 cents; next million, 18 cents; next 3,000,000 ft., 16 cents; all above 5,000,000 ft., 15 cents a thousand.

Rates to Go Up After Dec. 1 at Spencer, Mass.

The Spencer Gas Company is giving notice to its consumers of an increase in the gas rates, which will amount to about 10 per cent. The company claims that it is absolutely imperative for it to go up on the price, which will go into effect on bills of Dec. 1. Increased cost of materials and labor is given as the cause.

The new rates will be: For general use, first 2,000 cu. ft. per month, $1.70 net per thousand. All over 2,000 cu. ft. per month, $1.60 net per thousand.

For industrial purposes: First 2,000 cu. ft. per month, $1.70 net per thousand; next 3,000 cu. ft. per month, $1.60 per thousand; next 25,000 cu. ft. per month, $1.20 net per thousand; next 20,000 cu. ft. per month, $1.10 net per thousand, and all over 50,000 cu. ft., $1.10 per thousand.

The above rates are applied on all bills paid on or before the 10th of the month in which they are rendered.

On all bills paid after the 10th the above rates will be increased 10 cents per thousand feet on the first 30,000 cu. ft. per month.

Coal Consumption and Storage Report Blank

UNITED STATES FUEL ADMINISTRATION
Return to Statistical Department, Room 4205, Interior Building, Washington, D. C.
Investigation of coal consumption and storage.

October, 1917.

Products manufactured, in order of importance_____

Name of company_____ Name of plant_____

Address of company_____ Location of plant_____

Make out a report for each plant. Extra blanks will be supplied on request.

1. Fuel used (bituminous coal, anthracite, coke, oil, or natural gas) (Cross out those not used. Give bituminous coal in net tons (2000 pounds), and anthracite in gross tons (2240 pounds).

	Quantity consumed in calendar year 1916	Quantity consumed in first 9 mos., 1917	Estimated requirements for months of--			
	Tons	Tons	December Tons	January Tons	February Tons	March Tons
Bituminous						
Anthracite						

2. What contracts have you, and with whom, for coal to be delivered between now and April 1, 1918?

Name of contractor	Address	Bituminous per month Net tons	Anthracite per month Gross tons

3. What is the maximum storage capacity for coal at this plant?_____

4. Coal in storage at plant:

	Oct. 1, 1916.	Oct. 1, 1917.
Bituminous	_____ net tons	_____ net tons
Anthracite	_____ gross tons	_____ gross tons

5. Do your operations require a special grade of coal? (Specify)_____
6. From what mine or mines or through what dealer or selling agent are you now obtaining your coal?_____
7. Have you railroad connections at this plant?_____
8. Have you facilities for unloading self-dumping cars?_____
9. Do you purchase electric power?_____ How much monthly_____ From whom?_____
10. Are you manufacturing under direct contract with U. S., or Allied governments?_____ Under sub-contract?_____
11. Name exactly U. S. department and bureau (including Emergency Fleet Corp'n), or Allied government, placing contract_____ Contract No._____

Date signed_____

Name and title of officer signing.

ABOVE IS SHOWN THE FORM SENT OUT BY THE FUEL ADMINISTRATION IN THEIR INVESTIGATION OF COAL CONSUMPTION AND STORAGE

Chicago Suburbs May Have Rate Increased

Gas users along the north shore may have to pay an increase of 30 per cent above the present rates if the State public utilities commission acts favorably upon a petition presented yesterday by the North Shore Gas Company. According to officials of the company, increase in the cost of materials and higher prices demanded for labor makes necessary the increase sought. This effects the Chicago suburban towns of Winnetka, Waukegan, Lake Forest, Libertyville, Highland Park, North Chicago and Lake Bluff.

Army Hospital Unit at Tacoma Will Use 500,000 Cubic Feet of Gas Monthly

The hospital unit at Camp Lewis (American Lake, Wash., cantonment), which will be supplied gas for cooking, laboratory work and in sterilizing rooms by the Tacoma Gas Company, will use approximately 500,000 cu. ft. of gas per month.

Gas and Flame Regiment Needs Volunteers

Major E. J. Atkisson, Corps of Engineers, U. S. Army, is organizing the first battalion of a "gas and flame" regiment, the Thirtieth Engineers, at Camp American University, D. C. The new unit, which will be under the command of Col. A. A. Fries, who is now in France as chief of the gas service, needs chemists, chemical workers, machinists, men experienced in gas manufacture, pipe fitters, boilermakers, automobile repair men, electricians, etc.

Men with the proper qualifications, between the ages of eighteen and forty, who have not been actually called by a local board in the draft, are urged to enlist. They should go to the nearest recruiting station, state fully their qualifications, and request to be enlisted in the Thirtieth Regiment of Engineers.

The Thirtieth is the pioneer regiment in the gas and flame service. Major Atkisson points out that this organization will require a large proportion of men able to assume responsibility and to act upon their own initiative and individual judgment. There will, he states, be opportunities to advance to the higher non-commissioned grades. There will also be opportunities for commissions.

All men must first enlist as privates, the rate of pay being $33 per month and expenses. Men with the necessary experience may be assigned to special duties and given non-commissioned rank at rates of pay ranging from $40.20 to $96 per month and expenses.

ALBERT C. VAN DRIESEN has been apopinted secretary and treasurer of the Toledo (Ohio) Railways & Light Company, to succeed C. E. Murray, who has recently been transferred to another property. He was formerly Mr. Murray's chief clerk. Mr. Van Driesen has been with the company about eight years, starting as ticket agent.

Mischief Causes $30,000 Damage in Chicago in One Year

Approximately $30,000 damage to gas and electric street lamps each year in Chicago is occasioned by malicious mischief, according to a statement by William G. Keith, commissioner of gas and electricity. Mr. Keith has just issued an appeal asking the general public to co-operate with him in checking the depredations.

Duluth By-Product Plant Working at Top Speed

The Zenith Furnace Company is working its plant at full capacity in an endeavor to supply the increasing demand for iron, coke, gas, tar and ammonia. The plant, which is the largest in West Duluth, is situated at the foot of Fifty-eighth Avenue, West. An average of 400 men are employed constantly in the various departments.

Workmen are engaged at present in the construction of a huge gas container which will be used for the storage of the gas supply for Duluth and Superior. The daily production of gas at this plant is 3,500,000 cu. ft. This is sold to Duluth and Superior for illuminating and cooking purposes.

The operations of the plant include a blast furnace, coal dock, coke ovens and a terminal railway. The plant covers a total of 150 acres.

An average of 250 tons daily of foundry, malleable and Bessemer iron are produced by the furnace. The market for this iron includes Minnesota, Montana, Washington, Oregon, California, Colorado, Iowa, Wisconsin, Missouri and Kansas.

The coke ovens at the plant comprise an ore battery of sixty-five ovens, fifty of which were constructed in 1904 and fifteen in 1916. These ovens consume 500 tons of coal daily, producing each day 350 tons of coke, 3,500,000 cu. ft. of gas, 5,000 gallons of tar and 2,200 pounds of ammonia.

The company's coal dock is 2,100 ft. in length and 250 ft. wide with a daily unloading capacity of 7,500 tons in ten hours. It has a storage capacity of 375,000 tons and a unloading capacity of 2,700 tons daily.

Coal Contract for 200 Tons Per Month Secured by Fort Madison Company

The Fort Madison Gas Company, of Fort Madison, Iowa, will suffer no coal shortage in the future. Arrangements have been completed by that company with a West Virginia coal company for the supplying of coal at the rate of 200 tons a month to the local plant, according to advices coming to the members of the local Federal fuel commission. The securing of such a contract at this time is regarded as extremely fortunate.

The Federal Fuel Commission has supplied this local utility company with a carload of coal, which will aid in tiding the gas company over its immediate difficulties.

Many citizens, realizing that the gas company was hit by the shortage of coal that has been felt generally throughout the country for the past few months, feared that conditions might reach a point where the company would be forced to close down its plant.

The officials of the concern through strenuous efforts offset such a possibility, however, and the securing of the contract with the Eastern firm for the large amount of coal is an example of their success.

Boston Company Output Increased

The gas output of the Boston Consolidated Gas Company for October was 545,424,000 cu. ft., an increase of 8.8 per cent over the corresponding month a year ago.

Natural Gas Company Discontinues Operation

A certificate showing that the Depew & Lancaster (N. Y.) Light, Power & Conduit Company has surrendered its charter was filed recently with the Secretary of State. The certificate is signed by A. A. Crawford, Bradford, as president, and D. Robertson, Pittsburgh, Pa., secretary and treasurer.

Societies and Associations

THE GAS EMPLOYEES' ASSOCIATION of the Pittsfield (Mass.) Coal Gas Company held a meeting Thursday evening, Nov. 8, which was made notable by the presence of several of the men from the Charlestown Navy Yard, who have been in Pittsfield for the past week in the interest of the sailors' relief fund for the needy families of the enlisted men. The meeting hall in the gas office building was appropriately decorated for the occasion with the national emblem and potted plants. A supper was served by the gas men, at the conclusion of which Chief A. C. Jasperson, in charge of the local navy recruiting station, gave an interesting description of the makeup of a battleship and told of the many wonderful departments that were essential to the operation of the modern man-of-war. A discussion followed. Chief Jeffery and a quartet were also present and gave a pleasing concert. The boys are clever musicians, and their program demanded many encores. A short talk was also given by Chief Jeffery. At the business session that preceded the entertainment the matter of increasing the membership fee of the association was discussed. The matter will be decided at the December meeting.

Personal Notes

LESLIE G. WRIGHT has recently been transferred to the Astoria Light, Heat & Power Company at Long Island from the Walter Reed Hospital in Washington to assume his duties as chemist in connection with gas bombs and other chemical warfare. Mr. Wright left Hartford, Conn., in October for Camp Devens, where he was assigned to the 302d Field Artillery. After several weeks there, he was sent to Washington, where he has been doing sanitary work. He was formerly employed as a chemist at the New Departure Manufacturing Company.

WILLIAM E. MCCLINTOCK, who has been with the National Utilities Company for the past two years as consulting engineer in charge of the reorganization of various gas and electric light properties, will sever his connection with that company about the first of the year and resume consulting practice, with offices in New York City. Among the properties which Mr. McClintock has reorganized for the National Utilities Company are the Lambertville Public Service Company and the New Hope Electric Company, of Lambertville, N. J.; the Newton Gas & Electric Company, of Newton, N. J.; the New Jersey Gas & Electric Company, of Dover and Wharton, N. J., and at the present time he is in Port Arthur, Texas, in temporary charge of the work of reconstruction of the Port Arthur Gas & Power Company. In handling matters before State commissions Mr. McClintock has the advantage of a legal training as a member of the bar, having practiced law in the State of Massachusetts for a number of years before getting into the utility business. Mr. McClintock intends to make a specialty of examinations and reports on utility properties, work before commissions and reorganizations.

THE CITIZENS GAS COMPANY, of Burlington, Wis., at a recent annual meeting of the stockholders elected the following officers: President, H. A. Rinkel; secretary, W. H. Bushman, and treasurer, Eda Meinhardt. The following directors were re-elected: Henry Kies and W. H. Bushman.

THE PEOPLES GAS LIGHT & COKE COMPANY, of Chicago, Ill., in accordance with the provisions of an ordinance of two years ago, are having a valuation set on their property. Callistus S. Ennis, Harry Goldstine and Walter Mills have been appointed appraisers by the council committee on gas and electricity.

HENRY T. LEDBETTER has been appointed auditor for the Toledo (Ohio) Railways & Light Company. He comes from the Empire District Electric Company, of Joplin, Mo., another Doherty property, in which he held a similar position.

Construction Notes

New Gas Company Organized at Monroe, La.

According to reports received, the organization of the Monroe Gas Company, Inc., for the purpose of distributing gas in the city of Monroe, La., is under way.

Capitalized at $200,000, the company, it is said, has chosen officers as follows: Oscar Nelson, president; George G. Weaks, vice-president; Carl H. McHenry, secretary; Travis Oliver, treasurer; Louis Lock, manager of pipe-line construction. The officers, with Charles Schulze and R. L. Prophit, Jr., compose the board of directors.

Although plans of the company have not been officially announced, it is reported that the new company will take over the Louis Lock gas franchise here, and that an 8-in. pipe line to bring gas to the city, where it will be delivered to the Monroe Gas Company, shortly will be started.

General Manager Inspects New Improvements at Provo, Utah

A. S. Beringer, general manager of the Utah Valley Gas & Coke Company, is spending a few days in Provo, Utah, conferring with the local management and inspecting the new improvements made by the company on its extension to Springville and Spanish Fork. Upon being interviewed Mr. Beringer stated that he was well pleased with the outlook of the company's plant at Provo, and praised the work of J. M. Vick and Walter Adams, the local managers. In the early spring it is expected that they will extend their system to Payson.

During this summer the company has expended $100,000 in making the many improvements necessary at the main plant and the extension to the two adjoining cities, where he stated that they had about 350 customers.

Before coming to Provo, Mr. Beringer visited Denver and Billings, Mont., where he is negotiating on the purchase of some bonds for a bonding company which he represents. After making a complete inspection and planning the work for next year with the local management, which will include the placing of new mains in Provo and many other improvements, Mr. Beringer will leave for Port Arthur, Tex., where the company is operating another gas plant.

Tar and Oil Pipe Line Connects Plant With Railroad Siding

Manager Milton K. Burgner and Foreman John Wolff, of the Chambersburg (Pa.) Gas Company, have put in operation a scheme which has been declared impracticable by other gas men, and which, through its operation, means the saving and the making of money for the company.

It consists merely of a pipe line running about 500 ft. from the gas works across Lincoln Way West to a point on Hood Street, where a Western Maryland siding is. Through this pipe line, by means of a steam pump, gas tar is pumped from a tank at the works directly into the tank cars on the siding. In the same manner reversed oil from which gas is made is pumped from the tank car into the big iron holders at the gas works. Mr. Wolff was formerly an employee of the Harrisburg Gas Company.

Main Extensions Ordered by Pennsylvania Commission

Public Service Commission at Erie, Pa., in a recent ruling, ordered the Pennsylvania Gas Company to extend its mains in Erie when requested by property owners. Since the gas shortage of last winter the company has refused to grant extensions. Real estate men complained the action of the company retarded the development of properties in the city.